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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 30 JULY, 1947 NUMBER 7

# CYCLODIALYSIS: A FOLLOW-UP STUDY*

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*Detroit*

Since Heine,[1] in 1905, first described a procedure for operative detachment of the ciliary body from its insertion, the operation, which he termed cyclodialysis, has passed through various phases of popularity. Now, after more than 40 years of use in the treatment of glaucoma, reëvaluation of the procedure is indicated. As part of such a reëvaluation, a follow-up study of 121 cyclodialysis operations is the basis of this paper.

The first operative procedure to employ incision through the insertion of the ciliary body to form a communication between the chambers of the anterior segment and the suprachoroidea was that of Hancock[2] in 1861. He described six cases in which the operation was used. The procedure was modified by Heiberg[3] of Christiania. In 1900, Querenghi[4] described a procedure similar to those of Hancock and Heiberg. He called it a sclerocyclotomy or sclerochoriotomy. A transverse incision was made through the sclera and uvea behind the insertion of the ciliary body. Querenghi believed that glaucoma depended upon the lack of communication between the suprachoroidal space and the anterior chamber.

Chibret,[5] in 1897, described a procedure, which he called a sclero-cyclo-iridic puncture, for the treatment of glaucoma. He made an incision through the sclera, 3 to 4 mm. from the limbus, and guided the knife through the anterior portion of the ciliary body into the anterior chamber. When the point of the instrument appeared in the anterior chamber, it was directed backward to spear the iris which was then pulled toward the pupillary center. The procedure was repeated in 5 or 6 meridians. Eserine was used to pull the iris from the angle.

These contributions played no part in Heine's work but are cited only as evidence of the evolution of thought along this line. Heine's work was based on the observations of Fuchs and Axenfeld. Fuchs,[6] in 1900, had found a choroidal detachment associated with low intraocular pressure after about five percent of his operations for senile cataract in otherwise normal patients. Two years later,[7] he observed them after iridectomies for glaucoma. Axenfeld[8] saw choroidal detachment in 10 percent of patients after iridectomy, sclerotomy, and incisions in the chamber angle. He brought up the question as to whether choroidal detachment had anything to do with the action of iridectomy in glaucoma. Demaria in Axenfeld's clinic then demonstrated, in an eye after iridectomy for glaucoma, a tear in the ciliary-body insertion which permitted communication between the suprachoroidea and anterior chamber.

* From the Illinois Eye and Ear Infirmary, University of Illinois College of Medicine, and Michael Reese Hospital, Chicago. Under a grant from the W. K. Kellogg Foundation. Presented before the Chicago Ophthalmological Society February 17, 1947.

This suggested that perhaps an artificial communication of this type would be useful in lowering intraocular pressure in glaucoma.

Heine first reported 26 operations, then a total of 56, in 1906.[9] In 1913,[10] he reported on 103 eyes on which the operation was performed. The procedure he described included a conjunctival incision, 8 to 9 mm. from the limbus, in either of the four quadrants, between the rectus muscles. The sclera was bared and an incision 2 mm. in length was made in the sclera, 4 to 5 mm. from, and concentric with, the limbus. Through this opening a spatula was inserted between the sclera and choroid into the anterior chamber, and the ciliary-body insertion was severed.

The operation was done on blind or nearly blind eyes and on various types of glaucoma in the first series of operations. Heine's reports were followed by many others. Meller[11] reported 48 cyclodialysis operations in 42 cases. Wernicke[12] described 67 cyclodialyses (20 of which had been in Heine's reports). Elschnig,[13] Boldt,[14] Waldstein,[15] Meissner and Sattler,[16] Windrath,[17] and Knapp[18] added many cases to the early reports. Salus[19] then accumulated all the data on cyclodialysis up to 1920 for his comprehensive report. Since then, anatomic and gonioscopic data have established the *modus operandi* of cyclodialysis.

Heine's original idea was that the operation would produce a new pathway whereby aqueous would enter the suprachoroidal spaces and be slowly absorbed. Krauss,[20] in 1907, undertook to determine the mode of action of cyclodialysis by performing the operation on 20 eyes of rabbits and 12 eyes of cats. In all cases, a solid cicatrix formed at the operative site. The choroid and sclera became tightly adherent to the sclera. The angle of the chamber was obliterated in all. Krauss expressed the opinion that the operation acted by reducing the pathologic accumulation of intraocular fluid by producing a more or less extensive atrophy of the uveal tract.

Other investigators, including Judin,[21] Wichodzeff,[22] Wernicke,[12] and Elsberg,[23] had results similar to those of Krauss. Wernicke pointed out, correctly, I believe, that the mode of action of the operation cannot be determined by animal experiments. This same conclusion was drawn by Elschnig,[24] in 1932, after Stoutenborough[25] and Loddoni[26] reported experiments on animals in which they found no atrophy of the ciliary body after cyclodialysis.

Gradle,[27] in 1920, was of the opinion that the reduction in intraocular pressure after cyclodialysis was due to freeing of the angle of the anterior chamber, allowing aqueous to escape through the canal of Schlemm. Beard[28] was of the same opinion. Apparently this theory was held by many in the United States for, in 1914, the contributor to the *American Encyclopedia of Ophthalmology*[29] stated that "from the few glaucomatous eyes which have as yet been examined after this operation, it is not possible to state whether the procedure can reopen the angle of the anterior chamber."

Salus,[19] in his comprehensive paper, in 1920, concluded that the pressure-relieving effect of cyclodialysis depends on a partial atrophy of the ciliary body which results from obliteration of numerous arteries, and perhaps also from damage done to ciliary nerves.

In the reports on eyes enucleated after unsuccessful cyclodialysis by Heine,[1] Krauss,[20] Weekers,[30] Meller,[11] Wernicke,[12] Meissner and Sattler,[16] Elschnig,[13] von Grosz,[31] and Kronfeld,[32] no cleft was found. Atrophy of the ciliary body at the site of operation alone, was present in Weeker's, von Grosz's, and

Kronfeld's cases. In the others, atrophy was also present elsewhere in the ciliary body.

Elschnig had been of the opinion that the cyclodialysis operation acted through irritation of the iris and by straightening of angulated veins in the iris root, but in 1932[24] he had the opportunity to examine an eye of a patient who had had a successful second cyclodialysis 14 years before. He found a definite communication between the suprachoroidea and the anterior chamber. This was the first proof of Heine's original contention. It has since been amply corroborated by gonioscopic studies.

The first gonioscopic evidence of the mode of action of cyclodialysis was presented by Vannas[33] in 1935. He studied 37 cases of cyclodialysis and found patent clefts in 20 and none in 13. In 30 of the 37 there was normal tension. Four of the eyes with open clefts had been operated upon from 8 to 13 years previously.

In 1936, Barkan, Boyle, and Maisler[34] reported the gonioscopic data in 14 cases of primary glaucoma in which cyclodialysis had been done. In each of 11 cases in which the operation had been successful, a patent cleft was found. In three unsuccessful cases, reattachment of the ciliary body had occurred. In one of the latter, a second cyclodialysis was successful and resulted in the formation of a patent supraciliary cleft.

In 1940, I studied a series of 65 cyclodialyses on eyes with primary glaucoma and 56 cyclodialyses on eyes with secondary glaucoma following cataract operations, and found an "all-or-none" relation between success of the operation and the formation of a patent supraciliary cleft. This study was published in 1941[35] and 1943.[36] After an interval of 5 to 6 years, I have reviewed this same series of cases to determine the validity of my original conclusions.

Let us consider first the series of 65 operations for primary glaucoma. Of the 65 cyclodialyses, 34 (52.3 percent) were successful in reducing the tension to normal. The tonometric tensions varied from 8 to 21 mm. Hg (Schiøtz), averaging 15 mm. in 33 cases. In one case the tension at times reached 32 mm. Hg and so required miotics for control. In this case there was a very small patent cleft involving about 5 to 10 degrees of the circumference of the angle. In each of the 33 other cases, there were patent clefts. In the 31 cases of unsuccessful cyclodialysis, no cleft formation was revealed. In nearly all cases, there was stripping of a portion of Descemet's membrane, and in some there was reattachment of the ciliary body posterior to its original position. Thirteen of these cases were of the congestive type of glaucoma and 52 had simple glaucoma.

Since the early experiences with the cyclodialysis operation, warnings have been made repeatedly against using the operation in congestive glaucoma. Heine[1] realized this, in 1905, when he stated that the more urgent the indications the less beneficial are the results of cyclodialysis. However, the operation has been used with success in some cases of acute glaucoma, particularly where iridectomy has failed. Csillag[37] reported 10 successful cases including one of six-years' duration. Bangaerter and Goldmann[55] advised the operation in "inflammatory glaucoma" where iridectomy had been unsuccessful.

### Review of case reports

In my first report I divided the cases of cyclodialysis for congestive glaucoma into eight cases of cyclodialysis done for acute glaucoma and five for chronic congestive glaucoma. Although I now consider both groups together under acute

(narrow-angle) glaucoma, I shall consider the follow-up study on these cases under the two original subdivisions.

### Cases of acute glaucoma

Of the eight cases of cyclodialysis on eyes with acute glaucoma, the original observations indicated success in three and failure in five. Of the three successful cases, one experienced an acute attack nine months later, requiring further surgery. A second, operated in 1937, was still successful, with an open cleft, in 1946. The third is interesting enough to warrant description in detail.

This 27-year-old man had experienced blurring of vision, pain, and often slight injection of the right eye intermittently about twice weekly since the age of 17 years. These episodes usually occurred after seeing a motion picture or after reading, usually at night. On November 29, 1938, his pupils were dilated for refraction with 2-percent homatropine hydrobromide. The pupil of the right eye never returned to its normal diameter. Two days later he began to have pain and slight injection of the right eye. When seen four days later, the tonometric reading for the right eye was 60 mm. Hg (Schiøtz). The conjunctiva was very slightly injected. Miotics were ineffective in reducing the tension to normal. A trephination done on January 11, 1939, on the right eye was unsuccessful. It was followed on February 8, 1939, by a right cyclodialysis. This was successful. The tension remained low and the cleft was visible gonioscopically. However, nearly four years later, on December 8, 1942, the right tension was elevated to 52 mm. Hg (Schiøtz). On eserine therapy the tension returned to normal and has remained normal on miotics until the time of writing. The cyclodialysis cleft is open but shallow.

This case indicates the possibility of recurrence of acute glaucoma even in a previously, successfully operated eye where this particular operation has been used. It also indicates that the cleft may again regain its patency under miotic therapy.

Of the five cases of cyclodialysis done on eyes with chronic congestive glaucoma, two were unsuccessful at the time of my first report. One of the successfully treated eyes remained normal until the present time. The second could not be followed after the year 1941. The third remained normal with an open cleft from 1939 to 1944, when a lens extraction was done. The eye subsequently became hard and even light perception was lost.

As a group, these cases of narrow-angle acute glaucoma may respond successfully to cyclodialysis; however, the cleft may be closed either by a recurrence of the original angle-blocking process or by subsequent surgery.

### Cases of simple glaucoma

The remaining 52 eyes, upon which cyclodialysis for simple glaucoma was performed, represent the bulk of the follow-up series of primary glaucoma. The observations made for my first report indicated that there was no recurrence of ocular hypertension in the 28 successfully operated eyes following subsidence of all postoperative reaction. The longest interval between operation and observation was five years.

Now, after an additional six years, 11 of the 28 eyes have remained normal with open cyclodialysis clefts, and 13 could not be checked during the entire follow-up period because of death or because the patients did not return to the clinic. All of the eyes in this group of 13 had normal tension (one later required miotics for control) and an open cleft as long as they were followed.

Two other eyes were normal and had an open cleft until a cataract extraction was done, following which the glaucoma recurred. In one of these a second cyclodialysis was successful in returning the tension to normal and resulted in an open cleft. This patient was followed for only one year after the second cyclodialysis operation. Another patient had had an open but shallow cyclodialysis cleft for a year after operation but did not return to the clinic until five years later, at which time the eye was hard and the cleft closed. The one remaining eye of the series of 28 was one which continued to have a low tension, but the cyclodialysis cleft could not be seen.

As was previously pointed out,[35] the presence of synechias in the chamber angle before operation had little effect on the success of the operation. Twenty-four of the 65 eyes were observed preoperatively with the gonioscope. Four of these had acute glaucoma, two had chronic congestive glaucoma, and 18 had simple glaucoma. In the four eyes with acute glaucoma the angles were completely obliterated before operation. Two of the four cyclodialysis operations performed on these cases were successful. Of the two eyes with chronic congestive glaucoma, one angle was open and the other obliterated before operation. The one with the obliterated angle was normalized by cyclodialysis. The one with the open angle was not only an operative failure, but the angle was obliterated following operation except at the operative site where there was no cleft but where the angle remained open. Of the 18 eyes with glaucoma simplex which were gonioscoped preoperatively, 12 were open, four partly open, and two obliterated. Seven of the 12 open ones became normal after cyclodialysis. Two of the eyes with partly open angles became normal. Both of the eyes with obliterated angles were successfully operated. In all of the successful cases, there were open clefts.

### Cases of secondary glaucoma

The series of 56 cyclodialyses in 52 eyes with secondary glaucoma occurring after cataract operation presented similar follow-up findings. At the time of the original study 23 of the 56 operations were successful (41 percent). All of these had a cyclodialysis operation in the years 1939 or 1940. Seven of the 23 eyes continued to have open cyclodialysis clefts when examined in 1946, and 10 could not be checked during the entire follow-up period, because of death or because the patients did not return to the clinic. All of these eyes had normal tension and an open cleft as long as they were followed.

In the remaining six patients, the tension became elevated during the follow-up period. In one of these the tension rose to 60 mm. Hg (Schiøtz) in two years after operation. The cleft was obliterated at this time. In a second case, the tension rose to 37 mm. Hg after two years, but has usually been normal since then. However, because of corneal opacity which has developed during the interim, the presence or absence of a cleft cannot be determined. The four remaining eyes have had tonometric readings of up to 37 mm. Hg (Schiøtz) but continue to have small, open, but shallow, cyclodialysis clefts.

### Summary

In summary, then, the original 52.3 percent of successful outcomes in cyclodialysis in primary glaucoma has been reduced to 46.1 percent after 5 to 6 years. In secondary glaucoma after cataract extraction, the percentage of success after 5 to 6 years has been reduced from 41 percent to 30.3 percent. This reduction in the percentage of successful cases would seem to indicate the need for some

modification of my conception of an "all-or-none" relationship between success of the operation and the formation of a communication between the anterior chamber and the supraciliary space.

The modification of this concept would, however, be necessary only from a gonioscopic point of view, since at times one sees what appears to be an open, shallow cleft but its extent cannot be determined. If the cleft is shallow and extends only a very short distance back, it is usually functioning only partially. In some cases, diascleral illumination during gonioscopy is helpful in determining the extent of the cleft.

The tonometric readings should be considered in conjunction with the gonioscopic picture in drawing conclusions as to the functioning of a questionable cleft. In most cases, however, the presence or absence of a functioning cleft can be determined gonioscopically. Then, the "all-or-none" relationship certainly holds true. The fact that ocular hypertension recurs if the cleft closes is our best clue to the *modus operandi* of the cyclodialysis operation. It indicates that atrophy of the ciliary body is not the cause of success.

I have suggested that the markedly increased vascular wall-surface area made available through the cleft permits increased osmotic absorption of aqueous. That the cyclodialysis operation is an ideal substitute for the Schlemm's canal mechanism is shown by the response to anterior-chamber puncture in eyes of eight patients, all included in the follow-up series reported herein. Four of the eight cyclodialyses were done for glaucoma due to complete anterior synechias

TABLE 1

RESPONSE TO ANTERIOR-CHAMBER PUNCTURE IN EYES WITH CYCLODIALYSIS

| Patient | Type of Glaucoma | Tension before Puncture | Tension Immediately after Puncture | Tension after Puncture (mm. Hg Schiøtz) | | | | | Volume Aqueous (cc.) |
|---|---|---|---|---|---|---|---|---|---|
| | | mm. Hg | (Schiøtz) | ½ hr. | 1 hr. | 1½ hrs. | 2 hrs. | 2½ hrs. | |
| 1. M.H. | Post-cataract | 12.5 | 0 | 0 | 0 | 12 | 21 | 21 | 0.26 |
| 2. J.L. | Post-cataract | 21 | 0 | 2 | 8 | 12.5 | 22.5 | 26 | 0.185 |
| 3. C.C. | Post-cataract | 23 | 0 | 0 | 14 | 24.5 | 24.5 | 40 | 0.22 |
| 4. V.S. | Post-cataract | 12 | 0 | 0 | 0 | 10 | 17 | 24.5 | 0.14 |
| 5. A.J. | Acute glaucoma | 15 | 0 | 0 | 6 | 10 | 12.5 | 17 | — |
| 6. M.C. | Simple glaucoma | 21 | 0 | 0 | 4 | 6 | 10 | 14 | 0.24 |
| 7. C.C. | Simple glaucoma | 15 | 0 | 0 | 0 | 8 | 21 | 24.5 | 0.245 |
| 8. A.B. | Simple glaucoma | 30 | 4 | 18 | 30 | 40 | 46 | 40 | 0.19 |

following operations for cataract. Three others were for simple glaucoma, and the remaining one followed unsuccessful iridectomy for acute glaucoma. The results are shown in Table 1. Only in one patient, in whom the cyclodialysis was only relatively successful, was there a typical reactive hypertension. In another, a delayed rise to 40 mm. Hg (Schiøtz) was found. The chamber puncture caused no subsequent change in the intraocular pressure or the cleft in these cases.

In certain cases where the tension has been successfully reduced but no cleft can be seen, failure to determine the cause of success is disconcerting. However, one may find the cause in some instances, not in others. In one instance, I observed subconjunctival filtration at the site of the scleral incision where choroid was incarcerated in the wound. In another the cleft could not be seen because an anterior synechia had formed a bridge between the iris and cornea and was located like a screen in front of the cleft. Only an opening at one side could be seen; so the presence of a patent cleft could only be inferred from the fact that the tension continued low.

One must, of course, be especially careful when observing the tension during the first six weeks after operation. During this period, even with no visible cleft, the tension may be normal. The eyes are usually somewhat injected and soft because of the reactive vasodilatation. When the eyes pale, the tension in such cases usually goes up.

In a study[35] to determine the length of time which may elapse after operation before one can judge the success or failure of cyclodialysis, I ascertained the time between operation and the first occurrence of tension above 28 mm. Hg (Schiøtz) in 19 eyes with simple glaucoma, in which the cyclodialysis clefts had closed and the tension had become elevated. For the eyes with normal tensions at the time of the first return visit, the interval between operation and recurrence of hypertension varied from 1 to 16 weeks, averaging 5.8 weeks.

Closure of a previously open and functioning cyclodialysis cleft, as a result of subsequent cataract extraction, is to be expected but does not always occur. In one of the successfully operated cases in this series, a cyclodialysis was done in January, 1938, after an unsuccessful trephination. The cleft remained open, and the tension continued to be normal. In May, 1939, a right extracapsular lens extraction was done. The cleft remained open subsequently and was open when last seen in June, 1946. However, on several occasions since 1944, there have been slight increases in tension to around 30 mm. Hg (Schiøtz). The pocket is unquestionably decreasing in extent, but this cannot be determined gonioscopically. A second patient, not of this series, had had an iridectomy performed on the left eye in 1935. This was followed by a trephination in 1937, and later by a cyclodialysis during the same year. A patent cyclodialysis cleft was visible. An intracapsular lens extraction was done in February, 1946. The tension has remained normal since then. The cyclodialysis cleft has remained patent.

### Complications of cyclodialysis

The complications of the cyclodialysis operation may be divided into early and late groups. The early complications include surgical complications such as failure to cut all the scleral fibers in making the incision, episcleral hemorrhage, hemorrhages into the anterior chamber and vitreous, lacerations of Descemet's membrane, iridodialysis, subluxation of the lens, lens injury,[19, 41, 43, 45] perforation into the vitreous, and iridocyclitis.[19, 43] The late complications are hypotony,[40]

TABLE 2

INCIDENCE OF HYPHEMIA IN SUCCESSFUL AND UNSUCCESSFUL CASES OF CYCLODIALYSIS OF PRIMARY AND SECONDARY GLAUCOMA (FOLLOWING CATARACT EXTRACTION)

| | No Hemorrhage | Hemorrhage in Anterior Chamber | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Hemorrhage at Operation | | Postoperative Hyphemia Only | | | | | | Total Fresh Hemorrhages Increasing Hyphemia |
| | | Anterior Chamber Filled | Slight Hemorrhage | First Noticed 1st Day | First Noticed 2nd Day | First Noticed 3rd Day | First Noticed 4th Day | First Noticed 5th Day | First Noticed 6th Day | |
| Primary Glaucoma (total 65) 34 successful | 16 | 2 | 5 | 6 | 4 | 1 | | | | 5 |
| 31 unsuccessful | 9 | 4 | 8 | 5 | 3 | 1 | | | 1 | 6 (2 full) |
| Secondary Glaucoma following Cataract Surgery (total 56) 23 successful | 9 | 0 | 6 | 3 | 1 | 2 | 1 | 1 | | 5 (3 full) |
| 33 unsuccessful | 6 | 5 | 3 | 8 | 5 | 4 | 1 | 1 | | 10 (6 full) |

retinal detachment,[39] opacities of the cornea, ecstasia of the operative scar, cataract formation, changes in refraction,[19, 41, 43, 45] and closure of a previously patent cleft.

### Early complications

Of the early complications, the hemorrhages and lacerations of Descemet's membrane are the only ones which do not depend entirely on the operator's skill and care. McPherson[40] found anterior-chamber hemorrhages in 52.9 percent of 140 eyes at the time of operation, and an additional 6.5 percent at the time of the first dressing. Vitreous hemorrhages occurred in 5.7 percent of the cases he reported. He also found lacerations of Descemet's membrane in 5 percent. These lacerations rarely interfere with visual or tonometric results. The intraocular hemorrhages are one of the chief causes of closure of well-formed cyclodialysis clefts. The hemorrhages may be from the ciliary body or iris; or from vessels that pass from the ciliary body to the sclera which the spatula will sever, if these vessels are present. For this reason, and in order to prevent severe pain from the pulling on nerve loops, the horizontal meridian should be particularly avoided during the operation.

I reviewed the hospital records of all the patients in the follow-up series discussed herein to determine the relation between the incidence of hyphemia and the successful outcome of the operation (table 2). The incidence was probably greater than stated, especially since inadequate notes were found in some cases. Hyphemia occurred in 18 (52.9 percent) of the successful primary glaucoma cases and in 22 (70.9 percent) of the unsuccessful ones. In the secondary glaucoma cases following cataract operations, 14 (60.8 percent) of the successful ones, and 27 (81.8 percent) of the unsuccessful ones had hyphemia. It is apparent that hyphemia does not preclude success, but it is also true that lack of success is associated with a greater incidence of hyphemia. In the total of 121 cyclodialyses, hyphemia occurred in 56.1 percent of the successful cases and 76.5 percent of the unsuccessful ones. The incidence of fresh hemorrhages first occurring from 2 to 11 days postoperatively is also somewhat higher in the unsuccessful cases than in the successful ones.

In order to avoid unnecessary trauma and a too large cleft, which might result in hypotony, I formerly advocated[35, 36] a decrease in the extent of sweep of the cyclodialysis spatula. However, I have now reverted to a sweep of 120 degrees, still avoiding the horizontal meridian. The inverse cyclodialysis of Blaskovics[46] is preferable since it tends to reduce trauma.* When the eye is aphakic, the operation is done below. In nonaphakic eyes, the upper quadrants are preferred, in order to keep any hyphemia away from the cleft. When the cleft is made below, the patient is kept lying on one side after the operation.

In order to prevent postoperative closure of the cyclodialysis cleft, the use of physostigmine immediately after the operation and in the early postoperative period is recommended. In addition, I have found air injection helpful. After completing the cyclodialysis sweep, a blunt lacrimal needle attached to a syringe is inserted through the scleral in-

* The Blaskovics operation consists of a horizontal incision in the conjunctiva and Tenon's capsule at the level of the insertion of the superior rectus tendon, a vertical incision in the sclera extending 4 mm. from the insertion of that muscle toward the limbus, with the perforation 1.5 mm. long about 7 mm. from the limbus, and a sweep of 110-115 degrees with Elschnig's spatula. The insertion of the ciliary body is thus severed from behind forward. This operation may be applied to any meridian.

cision into the supraciliary cleft up to the chamber angle, and any aqueous present is withdrawn. The syringe is then partly filled with air which is then injected into the anterior chamber.

One may prefer to do both the dialysis operation and the air injection through the spatula devised by Randolph[47] who was the first to use air injection after cyclodialysis. After air injection, the cleft can usually be seen directly through the cornea. The air bubble pushes the iris and ciliary body backward, thus tending to keep the cleft open. The bubble persists for four days with usually some remnant visible on the fifth or sixth days. I have been unable to evaluate separately the effect of each factor in the operation in my own cases. However, the combination of factors has certainly improved my own results.

### Late complications

The late complications with which we are most concerned are cataract formation and changes in refraction in nonaphakic eyes, and closure of a previously patent cleft in both nonaphakic and aphakic eyes.

Cataract formation after cyclodialysis is probably related to hypotony.[54] Stein[42] reported 20 instances of cataract, which occurred in 24 percent of the hypotonic eyes in the group of private patients he studied. Statistics concerning cataract formation are difficult to evaluate because one cannot be certain that late cataract formation would not have occurred if the operation had not been done. Many of these cataracts probably result from a progression of previously incipient opacities. Early cataract formation should probably be attributed to operative trauma. Salus noted posterior subcapsular opacities which he considered characteristic and found mostly in hypotonic eyes. He reported 19 instances of cataract formation in 350 eyes.

The changes in refraction after cyclodialysis have been discussed by Salus,[19] Stein,[42] and Bunge.[43] Salus found an increase in refraction in 43 instances and a decrease of refraction, 11 times in 350 eyes. Bunge found increased refraction amounting to from 1 to 5 diopters in 13 eyes of patients with simple and chronic congestive glaucoma. Stein reported an increase in refraction of 0.5 to 4 diopters in 24 cases and a decrease in refraction, three times. The increased refraction was in the nature of a decrease in hyperopia in 12 cases, an increase in myopia in eight, and a change from hyperopia to myopia in four. He believed the change was due to the stretching of the zonule.

I reviewed the records of a series of 48 operated eyes and 33 unoperated eyes with primary glaucoma to determine the amount of refractive change after cyclodialysis, as compared with the change after other operations and with refractive change in unoperated glaucomatous eyes. The results are shown in Chart 1.

The 48 operated eyes consisted of 14 following iridectomy, 12 after cyclodialysis, 11 after trephination, and 11 after iridencleisis. These patients were from the private practice of Dr. Harry S. Gradle and Dr. S. J. Meyer. All of the operated cases were selected on the basis of preoperative visual acuity of 20/25 or better and not less than 20/40, during the first year after operation. Only patients who had recently been refracted were included.

As for the 11 iridencleisis cases, the short one-year period of follow-up was due to the fact that most of the operations of this type were relatively recent. In the case of cyclodialysis, the one-year follow-up period was due in part to cataract formation and in part to the fact that secondary operations were relatively frequent so the cases could no

longer be included in this study.

In all types of operation, an average increase of refraction of 0.37 to 0.75 diopters occurred during the interval between the preoperative examination and the first postoperative examination.

In every group the average refraction

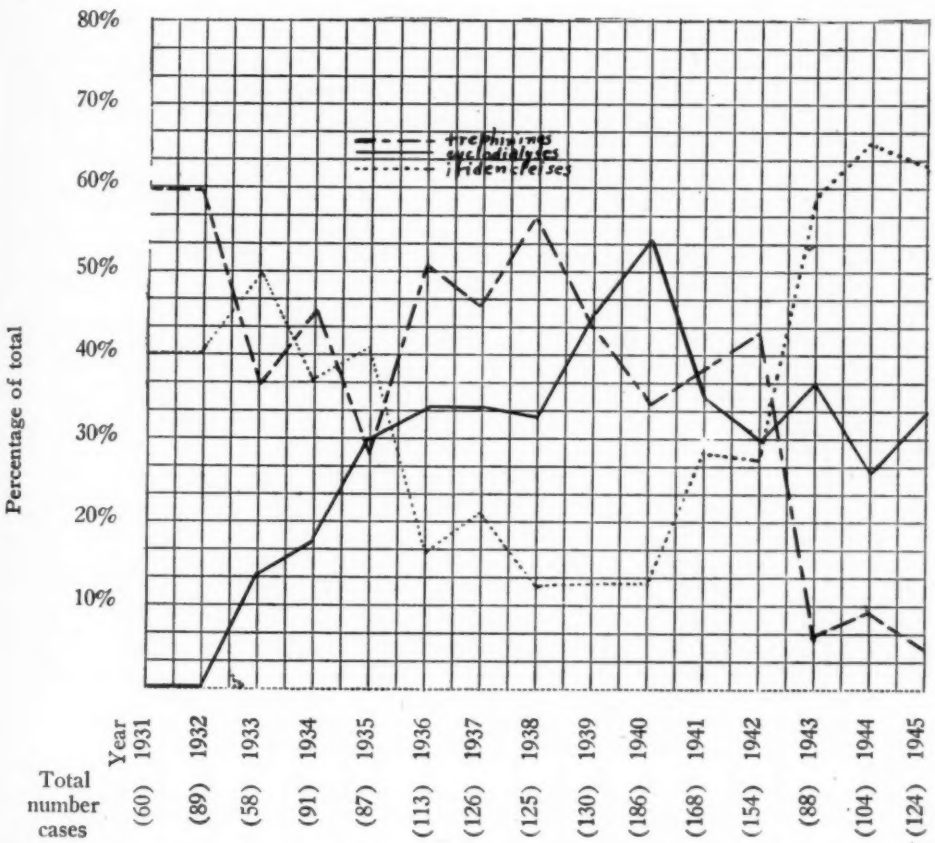


Chart 1 (Sugar). A comparison of cyclodialyses, trephinations, and iridencleises at the Illinois Eye and Ear Infirmary, Chicago, 1931 to 1945.

continued to increase as time passed. In the iridectomy group the change was least of all, reaching only 1.0 diopter after six years. The increase of 2.5 diopters more after eight years and of 4.75 more 10 years after operation must be considered as unrelated to the iridectomy procedure itself. There was relatively little difference between the first postoperative examination and the examination one year after operation in the cyclodialysis group. In the trephination group, the greatest postoperative change occurred in this small series.

Of the 12 cyclodialysis cases, two decreased slightly in refraction—in one case, only 0.25 diopters; in the other, 0.50 diopters. One showed no change. The nine remaining cases increased in refraction up to 2.5 diopters. Nine of the 12 had been hyperopic. Three of these became myopic.

Closure of a previously patent cyclodialysis cleft is one of the most serious of the late complications. It has been the cause of most of the objections to the operation. The duration of successful re-

sults after cyclodialysis has been the subject of several papers.[42-44] Stein[42] found, in a total of 120 cyclodialyses which had been done on private patients of Elschnig, that an average of 72 percent of simple glaucoma and 70 percent of chronic uncompensated cases had lasting success. In one case success had lasted

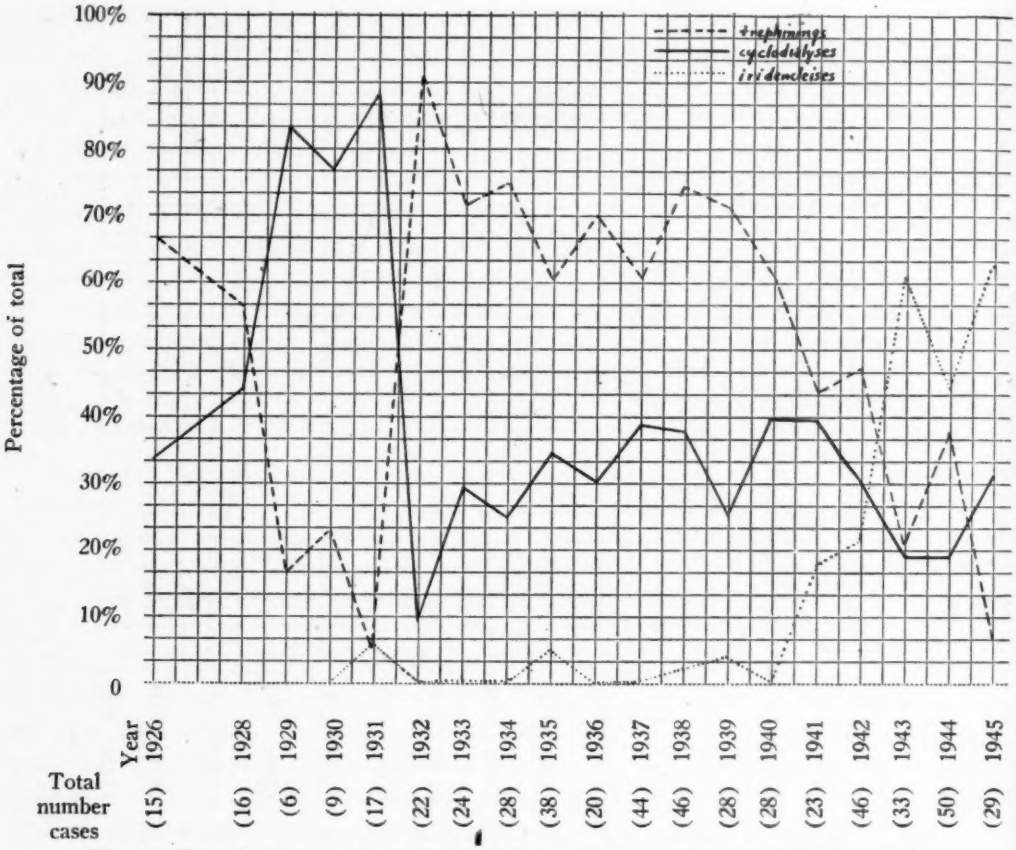


Chart 2 (Sugar). A comparison of cyclodialyses, trephinations, and iridencleises at the Michael Reese Hospital, Chicago, 1926 to 1945.

20 years. Of 393 cyclodialyses in clinic patients, he reported success in 79 percent of simple glaucoma cases and 68.8 percent of incompensated glaucoma cases. Bunge[43] found 68.9 percent success in simple and congestive glaucoma.

Hausmann[44] divided her cases into five groups. In the first group of 21 cases of postcataract glaucoma, 13 had lasting results—one case, 11 years; 3 over 6 years; 7 between 1½ and 4 years; and 2 were observed less than one year. In the second group, that of secondary glaucoma of various types, not including postcataract glaucoma, there were seven cases. In one, the tension remained normal for 13 years. The third group consisted of 34 cases of primary chronic glaucoma in which a cyclodialysis was the only operation. Eight of these were normal over a 4-year period. Two of the latter had normal tension and vision for 14 years. Seven were normal up to three years, and 12 were normal during an observation period of less than a year. The fourth group consisted of 22 cases in

which cyclodialysis was followed by other operations. Thirteen of these cases were helped. The fifth group was made up of 21 cases in which cyclodialysis followed other operations. In one case the tension remained normal for 14 years, and, in another, 9 years.

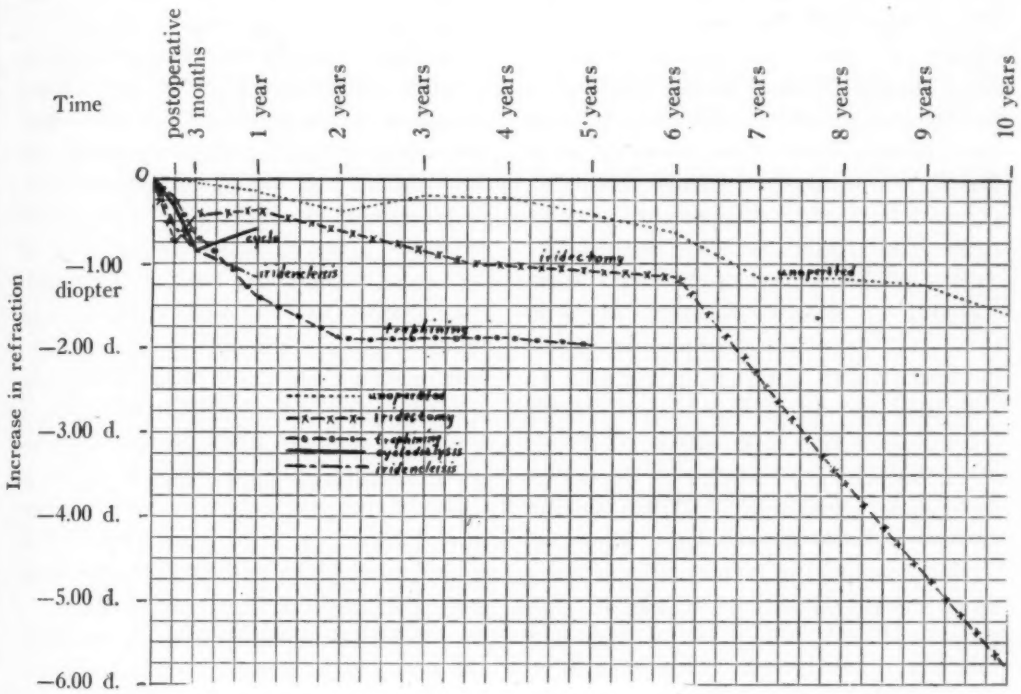


Chart 3 (Sugar). Refractive increase (averages) in unoperated glaucomatous eyes and after various operations for glaucoma.

Louhala and Teräskeli[54] reported a preliminary good result in 72 percent of cyclodialyses for simple glaucoma. After a period of 1 to 10 years of follow-up, good results were found in only 52 percent of the follow-up cases.

The frequency of employment of cyclodialysis as compared to other operations in the treatment of glaucoma gives an indication of the opinion held generally as to its efficacy. Von Grosz's[38] statistics concerning the Budapest Eye Clinic indicate that the cyclodialysis operation rose from zero in 1918 to over 50 percent of all glaucoma operations in 1923, remained about 50 percent, then rose to over 60 percent in 1933. Trephinations during the same period, 1918 to 1933, fell from 40 percent of all glaucoma operations to nearly zero in 1923, rose slightly to 10 percent in 1939, and remained at about 10 percent until 1943. Iridectomy had been the most frequent in proportion to the increased frequency of cyclodialysis.

Bunge cites similar statistics from other European authors of the period, 1918 to 1931. Similar but more recent results from the University of Helsinki are worthy of mention. Louhala and Teräskeli reported that, until 1930, trephination was the most common glaucoma operation in Finland. Iridencleisis came next in frequency. Between 1931 and 1942, cyclodialysis was the most frequent

operation (206 cyclodialyses in a total of 520 operations for glaucoma). Iridencleisis came next (165), then iridectomy (140), and lastly, trephination (5).

A review of the number of cyclodialysis operations compared to trephinations and iris-inclusion operations performed during the past 15 to 20 years at the Illinois Eye and Ear Infirmary, a state institution where no private work is done, and at Michael Reese Hospital, a private institutions where the eye patients were in large part from the practice of Dr. H. S. Gradle, gives an indication of the trends in glaucoma surgery in Chicago. The results of this review are shown in Charts 2 and 3. It would be interesting to compare these results with those of other institutions, especially those elsewhere in the United States.

It is worth noting that since 1940, the iris-inclusion operations have comprised about 60 percent of glaucoma operations (excluding iridectomy) in both institutions. In 1945, cyclodialysis comprised slightly over 30 percent of these glaucoma operations in both places. The graphs indicate considerable variation, however, in the trends between each institution. This was noted also among the six individual services of the Infirmary, indicating the importance of personal preference by each surgeon for a particular procedure.

The indications for cyclodialysis have changed remarkably during the period in which the operation has been in use. In 1914, the contributor to the *American Encyclopedia of Ophthalmology* wrote:[29] "The real indication for it (the cyclodialysis operation) is the impossibility of performing iridectomy from the presence of very high intraocular pressure and absolute glaucoma which has progressed far."

Meller[48] early preferred cyclodialysis to iridectomy in certain cases because it was decidedly less dangerous. The procedure was considered to be indicated in very hard eyes with very shallow chambers; in hemorrhagic glaucoma; and in those cases in which the fellow eye had been lost through malignant glaucoma or through severe hemorrhage following iridectomy; in aphakic eyes with fluid vitreous; and in hydrophthalmic eyes.

Elschnig considered cyclodialysis a valuable addition, especially for simple glaucoma, hydrophthalmos, secondary glaucoma, or when iridectomy could not be done or had failed. Waldstein[15] favored its use in simple glaucoma, and in secondary glaucoma due to luxated or subluxated lenses. In 1922, Elliot[49] considered cyclodialysis to have gone out of favor in hydrophthalmos.

In 1924, Fuchs[50] considered that the operation should be reserved for cases in which other operations have failed or proved fatal to the other eye, or cases in which iridectomy is difficult or dangerous. Meller,[51] in 1923, listed the indications for cyclodialysis as: (1) the early stages of glaucoma; (2) acute glaucoma in which iridectomy is difficult and dangerous; (3) patients who have lost one eye from malignant glaucoma or from severe hemorrhage after iridectomy, and also in old, restless people; (4) secondary glaucoma, including that due to anterior synechia in which the tension increased after cataract extraction.

Von Grosz,[52] in 1932, believed the indication for cyclodialysis to be "chronic inflammatory glaucoma." Gradle,[27] in 1920, considered the operation distinctly contraindicated in acute glaucoma of an exudative or inflammatory type, and in cases where immediate operation is desirable. He later,[53] in 1931, considered the indications for cyclodialysis to be: (1) simple noninflammatory glaucoma of the type just beyond the control of miotics; (2) simple glaucoma with high intraocu-

lar pressure and a visual-field defect extending to within 10 degrees or less of the fixation point; and (3) after unsuccessful but technically correct iridectomy.

McPherson[40] in his recent report from the Wilmer Institute advocated Gradle's dictum regarding the use of cyclodialysis in chronic simple glaucoma without inflammatory reaction. However, his report of 42-percent successful results in 45 cases of chronic simple glaucoma and in 35.9 percent of 39 cases following cataract extraction, which is similar to the results in my own series, does not appear to be as good as the reports made for trephination and iridencleisis for simple glaucoma.

Thus, although successful cyclodialysis in simple glaucoma gives an ideal physiologic result, theoretically, the percent of success is less than after the filtering operations. There are two exclusive indications for the operation: (1) glaucoma in aphakic eyes, no matter whether simple glaucoma, obstructive glaucoma due to complete anterior synechias, resulting from cataract operation, or glaucoma capsulare; and (2) secondary glaucoma due to posterior subluxation of the crystalline lens. In addition cyclodialysis may be successful in certain instances of narrow-angle glaucoma where a previous iridectomy has been unsuccessful. In simple glaucoma, cyclodialysis may be used, even with only about 45-percent success, since the operation does not carry with it the danger of late infection and since it may be repeated without damage to the integrity of the eye.

## Conclusions

1. A relatively small number of successful cyclodialysis operations, after varying periods of time, become failures or relative failures. The original 47.1 percent of success in a total of 121 cyclodialyses of all kinds, observed up to five years, was reduced to 38.8 percent after an additional six-year period.

2. The "all-or-none" relationship between success of the cyclodialysis operation and the formation of a supraciliary cleft is a fact, but must be modified from a gonioscopic view, since the depth of a cleft cannot always be determined by this technique.

3. Cyclodialysis operations may remain successful in some instances, in spite of subsequent cataract surgery.

4. An increase of refraction usually occurs after cyclodialysis, as it does following other glaucoma operations.

5. The trend in the use of the cyclodialysis operation in two Chicago hospitals has become somewhat less frequent in recent years, particularly in comparison to the recent increase in the use of the iridencleisis operation.

6. The two exclusive indications for cyclodialysis are: (1) glaucoma in aphakic eyes; and (2) secondary glaucoma due to posterior subluxation of the crystalline lens. In addition, the operation may be successful in cases of shallow-angle glaucoma where a previous iridectomy has been unsuccessful. In simple glaucoma, the percentage of success is relatively low, but the operation has certain advantages.

7. The percentage of success in the formation of clefts may be improved by separating the ciliary body from the scleral spur along a third of the angle circumference, preferably by the use of the Blaskovics technique. The use of eserine and the keeping of the patient in such a position after operation that any hyphemia will not settle in the cleft are advocated. The injection of air into the anterior chamber through the scleral incision by way of a lacrimal needle is suggested as an additional aid.

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# INVERSE CYCLODIALYSIS*

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The success of a cyclodialysis operation in controlling glaucoma is entirely dependent upon the production of a permanent cleft at the anterior-chamber angle through which aqueous can enter the suprachoroidal space. This fact was demonstrated microscopically by Elschnig,[1] in 1932, and confirmed gonioscopically, in 1936, by Barkan, Boyle, and Maisler,[2] and by Clarke,[3] in 1941. Any variation in technique is well worth while, if it makes more certain the production of this cleft and the prevention of hemorrhage. Such a variation is the inverse cyclodialysis of Blaskovics.

The operation of cyclodialysis was introduced in 1905 by Heine[4] and popularized in 1920 by Salus,[5] using the same fundamental procedure as is now employed routinely. Mauksch[6] has added suprachoroidal iridotasis to the routine cyclodialysis. Troncoso[7] has suggested the use of magnesium implants which, by producing hydrogen bubbles in the cleft, help to keep it open. Wootton[8] combined an iridectomy with the dialysis. An increasing number of surgeons are introducing air into the anterior chamber upon the completion of the cyclodialysis. The inverse maneuver is a fundamental change in technique devised by Blaskovics[9] and described by him in Szemeszet, in 1935. One other article by Pereira[10] in the Spanish literature reports using the operation successfully in one case. Other than this, no mention of the technique has been found in the literature, although an occasional surgeon in this country has used the method.

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## EXPERIMENTAL PROCEDURE

In 1944, Dr. Owen Dickson and I conducted a series of animal experiments, using dogs, cats, rabbits, and monkeys, to determine the effect of air injection into the anterior chamber following cyclodialysis. A cyclodialysis in a dog is complicated by extensive hemorrhage from the scleral incision. In order to control bleeding, a radial scleral incision was tried rather than the usual tangential variety. Since this incision paralleled the scleral blood vessels, there was a material decrease in bleeding.

Because it was found difficult to introduce an Elschnig spatula directly into the anterior chamber through the radial incision, the inverse technique was tried. The spatula was inserted laterally between the sclera and the pars plana of the ciliary body to the full extent of the spatula. The blade was then swept forward into the anterior chamber, effecting the separation in a direction opposite to that of the usual method; hence, the term, "inverse cyclodialysis."

In dogs, cats, and monkeys, the dialysis could be done more easily and with less force being applied to the spatula than in the routine type. There also seemed to be less anterior-chamber hemorrhage by this approach, even when the scleral incision was made tangentially.

In rabbits, a cyclodialysis is difficult to accomplish because of the friability of the iris and its intimate attachment to the sclera. Almost invariably the tip of the dialysing spatula appeared behind the iris when the routine approach was used. However, with care a cyclodialysis could be performed by the inverse approach.

Upon checking the microscopic anatomy of the ciliary body and its attachment to the sclera in glaucomatous and nonglaucomatous human eyes, it seemed that the inverse approach was a logical one. As shown in Figures 1 and 2, the fibers of the ciliary body run forward and are practically continuous with the trabecular fibers overlying Schlemm's canal. Part of the scleral spur actually lies in front of the canal. The angle of the anterior chamber does not end at the point of ciliary-body attachment at the scleral spur, but actually points into the ciliary body itself. Consequently, when an Elschnig spatula is pressed into the angle in the routine manner, it has to tear through anterior ciliary body, in some instances, before reaching the suprachoroidal space. This trauma would cause increased bleeding. A clot lying between the raw surfaces of a damaged ciliary body would encourage fibroblastic invasion which would tend to seal up the intended cleft. Thus, even in eyes without anterior synechiae, the inverse approach seems to follow a natural cleavage plane.

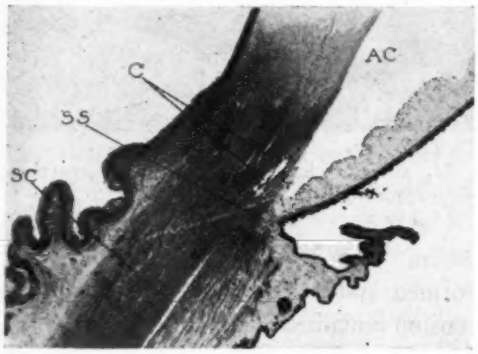


Fig. 1 (Shaffer). Normal open angle. AC, Anterior chamber; C, Schlemm's canal; SS, Scleral spur; SC, Suprachoroidal space.

This should help to dialyse the ciliary body from the scleral spur at the trabeculum with a minimum of trauma.

In the eyes with extensive anterior synechiae (fig. 3), such as occur in late glaucomas and particularly in postcataract glaucomas, the chances for an atraumatic and successful dialysis by the usual

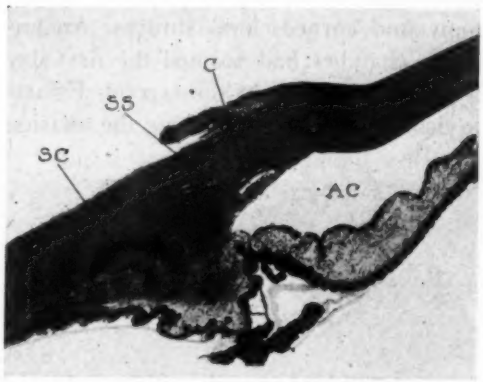


Fig. 2 (Shaffer). Normal open angle showing how easily anterior ciliary body can be torn by dialysing spatula approaching suprachoroidal space from anterior chamber. AC, Anterior chamber; C, Schlemm's canal; SS, Scleral spur; SC, Suprachoroidal space.

method seem to be definitely less. If, as the spatula is swept toward the angle, it encounters a firm synechia, there is a tendency for the iris to fold back in front of the spatula toward the posterior chamber. This might result in an iridodialysis, or merely in a failure to produce a true cleft. By using the inverse method, it would seem probable that the blade of the spatula would follow the line of cleavage between the synechiae and the cornea. One would reasonably expect that there would be less tendency to transfix the iris or to injure Descemet's membrane if the side-sweep of the spatula were employed than if its tip were thrust through the synechiae into the anterior chamber, as in the routine approach.

## Case reports

*Case 1.* Our first opportunity to use the inverse method in operating on a human being was in a highly unfavorable case seen in January, 1945. This was a

cataract patient with diabetes, which was difficult to control in the hospital and which was frequently uncontrolled under home conditions. She had had an extracapsular cataract extraction with full iridectomy and corneoscleral sutures. An anterior chamber had formed the first day but was collapsed on the second. Efforts to demonstrate a fistula along the incision line were unsuccessful. Aqueous could be seen between the cornea and the vitreous face in the pupillary area and behind the iris, but the entire extent of the iris was adherent to the cornea. Air injection between the iris and the cornea failed to free the adhesions. As one would expect, the tension was greatly elevated.

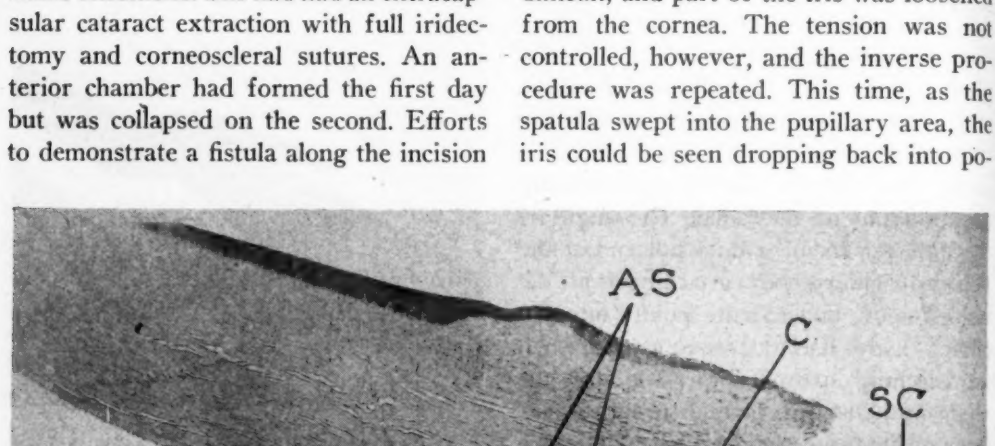


Fig. 3 (Shaffer). Angle showing anterior synechiae. AC, anterior chamber; AS, anterior synechia; C, Schlemm's canal; SC, Suprachoroidal space.

Six weeks after the cataract operation, it was decided to attempt a cyclodialysis. It seemed almost impossible to work the tip of a spatula past so broad a synechia to the pupillary area; so the inverse method was tried. The technique was not difficult, and part of the iris was loosened from the cornea. The tension was not controlled, however, and the inverse procedure was repeated. This time, as the spatula swept into the pupillary area, the iris could be seen dropping back into position. The anterior chamber was reformed and has persisted. Although the tension remained at 30 mm. Hg (Schiøtz), further surgery was not considered because the eye was essentially blind. After waiting several months, this patient's second eye was operated upon for cataract. The operation was uneventful; the incision was carefully sutured; a large air bubble was instilled into the anterior chamber. Again the chamber was shal-

low the first postoperative day, and completely collapsed the second. The iris remained against the cornea even though the vitreous face was pressed back in the pupillary area by aqueous. At the end of one week, an inverse cyclodialysis was performed without difficulty; a large air bubble was injected into the anterior chamber, and a posterior sclerotomy was performed to reduce posterior-chamber pressure. The chamber was restored, and the intraocular pressure remained in the normal zone.

*Case 2* was a patient with narrow-angle glaucoma who had had two previous cyclodialyses performed in the usual way. Very small and shallow clefts had been produced. The first one had held the tension at normal for only five months, the second for a year. An inverse dialysis, performed in an untraumatized portion of the angle, produced a large cleft which is functioning well at the present time.

*Cases 3 and 4* were patients with wide-angle glaucoma. One was secondary to a subluxated lens; the other to a glaucoma capsulare. In these we combined the inverse with the standard routine, sweeping inversely from the scleral side into the chamber, then completing the other half into the suprachoroidal space in the routine direction. The success achieved in these two cases completed our conversion to the Blaskovics' procedure; for, in both of these cases, the part dialysed routinely had no cleft whatever, and the part done inversely had beautiful clefts!

By July 1, 1946, 21 cases had been operated by the inverse method, and with one exception we have had no reason to question its worth. This one exception was a case of wide-angle, or chronic simple, glaucoma in a man, 47 years of age. The tension, 30 to 40 mm. Hg (Schiøtz) in one eye, could not be controlled by miotics. His seemed an ideal case for cyclodialysis. This was done by the inverse method with a minimum of trauma and bleeding. The following day the eye was stony hard. The conjunctiva was so edematous as to suggest a posterior venous thrombosis. Tension remained over 70 mm. Hg (Schiøtz) for two weeks despite the most energetic measures short of surgery. Gradually tension dropped back to 30 mm., leaving a mid-dilated, fixed pupil, corrected vision of 20/30, moderate field loss, a normal fundus, and an unsolved problem. The operative site showed no cleft gonioscopically. Explanation for the failure is lacking.

## Present cyclodialysis technique

### 1. Anesthesia

Premedication consists of nembutal (0.1 gm.) given the night before surgery and repeated the morning of surgery. Usually, morphine sulfate (10 to 15 mg.) is given hypodermically when the patient is called to surgery. Eserine (0.5 percent) is instilled twice before starting the anesthesia in order to keep the pupil miotic. Pontocaine (0.5 percent) is dropped into the eye at 3-minute intervals, 5 times. Meanwhile a Van Lint akinesis, and retrobulbar and subconjunctival injections of 2-percent novocaine and 1:20,000 adrenalin, are given. The rotrobulbar injection of 1.5 cc. is used 30 minutes before starting surgery to effect maximum softening of the eye. It also frequently deepens the anterior chamber, making the dialysis easier. Complete anesthesia is essential. If regional block is ineffective, general anesthesia is indicated.

### 2. Selection of operative site

That portion of the angle is chosen for cyclodialysis which gonioscopy has shown to be most widely open and most free of anterior synechiae and blood vessels. This permits the dialysis to be done

with a minimum of trauma and bleeding. If there is no choice, the upper temporal quadrant is chosen because of ease of access and because the patient can sit up postoperatively to allow any hemorrhage to run out of the cleft into the bottom of the anterior chamber. Authors usually suggest that the 180-degree meridian be avoided to prevent bleeding from the long posterior ciliary arteries. However, since

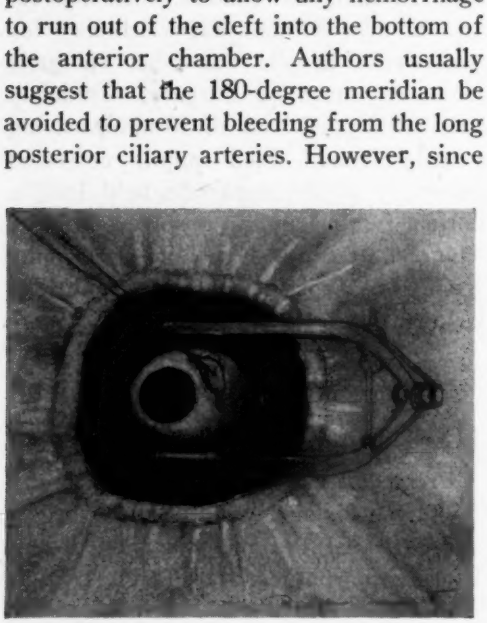

Fig. 4 (Shaffer). Conjunctival incision is 8 mm. from limbus. Scleral incision is 5 mm. from limbus. Traction suture in place.

these enter the posterior portion of the ciliary body, the dialysing spatula should not injure them. We have not seen increased bleeding from this area. The major portion of the dialysis should lie in the quadrant between the muscles to avoid the anterior ciliary arteries, which perforate the sclera 2 to 3 mm. anterior to the tendinous insertions.

### 3. Incisions

A 10-mm. conjunctival incision is made with scissors, 8 mm. from the limbus and parallel to it (fig. 4). The scleral incision should be 4 to 5 mm. from the limbus. It can be made with a No. 15 Bard-Parker blade, or with a keratome. The external incision should measure 4 mm. with a 1.5- to 2-mm. opening into the suprachoroidal space. It can be placed either radially, as suggested by Blaskovics,[9] or tangentially in the routine manner.

Since the radial incision has the advantage of running with the scleral fibers, there is less tendency for the wound to gape. It also parallels the blood vessels and reduces hemorrhagic tendencies. If there is any bevel to this radial incision, however, it becomes impossible to reintroduce the spatula under the scleral shelf should a second half-sweep be desired. Therefore, the radial incision should be perpendicular to the sclera, and the tangential one should be bevelled slightly toward the cornea. To avoid a ragged incision through which the introduction of a spatula is difficult, the cutting instrument should be held in the same plane at all times, and the perforation should be made in as few strokes as is consistent with safety. If any severe scleral bleeding occurs, it must be controlled by high-frequency coagulation, or by actual cautery. When the sclera has been completely incised, it is possible to depress one lip of the scleral wound by pressing upon it. The black ciliary pigment can then be seen in the depths of the incision.

### 4. Fixation

If a double inverse dialysis is contemplated, the tangential incision is usually chosen because of the greater ease of manipulation. When the scleral cut is half completed, a 4-0 Anacap suture is passed through the corneal lip of the incision. If the first bite is not a strong one, a second turn through the sclera is made. This then serves as a traction suture in making the dialysis. If a radial incision is made, contemplating only half of a dialysis, the traction suture is placed in the lip on the side of the contemplated dialysis. Although Elschnig forceps can be used for fixation, they have an unhappy faculty of

loosening their grip at a critical moment in the operation.

5. THE DIALYSIS

After the perforating incison is completed, the Elschnig spatula is placed in a horizontal position with the tip resting on one lip of the wound. When this is depressed, the ciliary body is pressed away from the under surface of the opposite scleral lip, and the spatula can be introduced with ease. If there is any resistance, it is because scleral strands remain at the depths of the wound, and these must be severed. As in Figures 5 and 6, the blade of the spatula is pressed gently forward along the inner surface of the sclera parallel to the limbus. Small side-to-side movements are made as the blade is advanced, both to avoid wrinkling the pars plana of the ciliary body in front of the spatula and to keep track of the tip of the blade which can usually be seen through the sclera. When the blade is introduced half way, considerable resistance is sometimes encountered. This means that the operator is holding the spatula too firmly against the inner sclera, and that the point must be slightly depressed. When the blade is completely out of sight under the sclera, it is slowly rotated (fig. 7) toward the anterior chamber. Resistance is felt when the scleral spur is reached. The operator should accomplish the dialysis with great care and deliberation. As the tip and side of the blade come into view at the angle, one must avoid pressing it upward against the cornea, or backward against the stroma of the iris. Rotation is continued until the blade is in the middle of the anterior chamber. It is then quickly

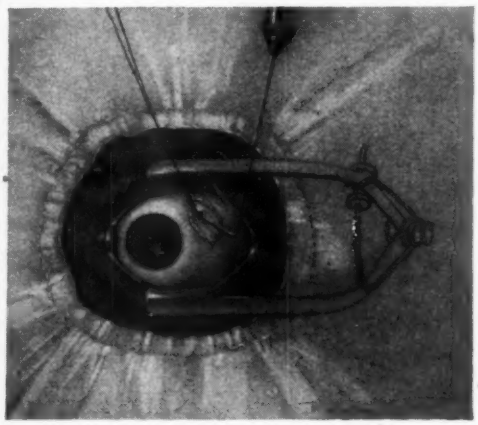

Fig. 5 (Shaffer). Introduction of Elschnig spatula into suprachoroidal space. Traction suture lifting anterior scleral lip.

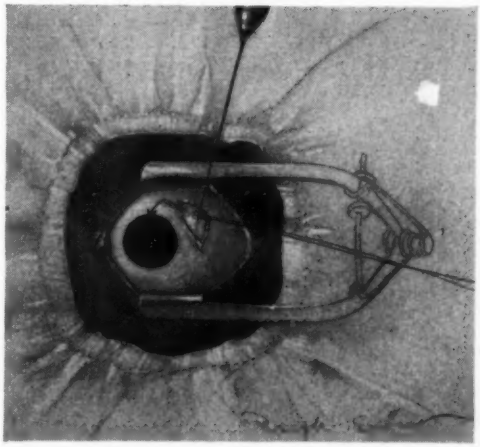

Fig. 6 (Shaffer). Elschnig spatula in suprachoroidal space parallel to limbus.

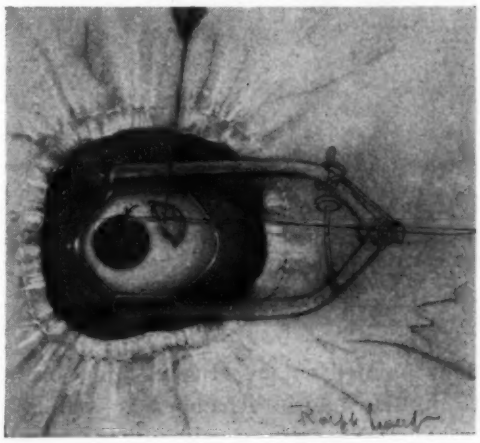

Fig. 7 (Shaffer). Rotation of spatula past attachment of ciliary body to scleral spur into the anterior chamber.

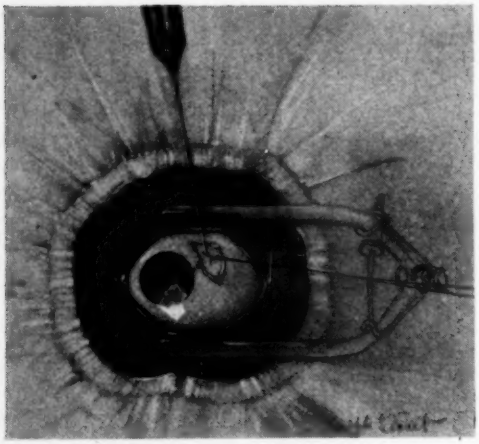

Fig. 8 (Shaffer). Completion of one half the dialysis. Spatula is withdrawn in this position.

removed (fig. 8). A second spatula can then be inserted in the opposite direction (fig. 9), to double the size of the cyclodialysis, if desired.

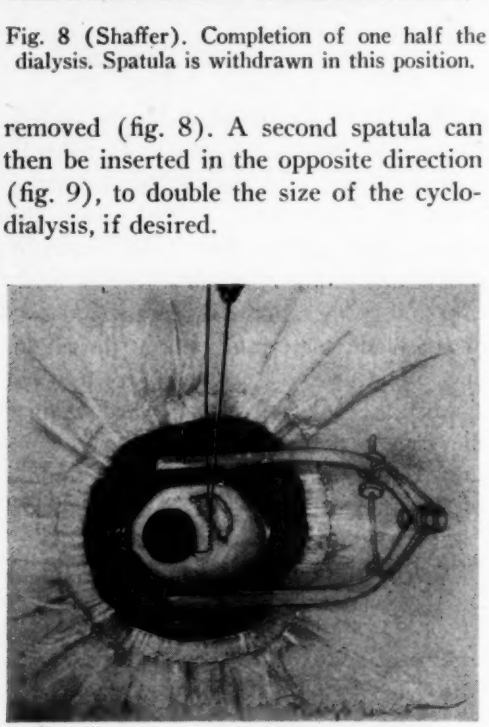

Fig. 9 (Shaffer). Introduction of the Elschnig spatula in the opposite direction. It is swept into the anterior chamber as in Figures 7 and 8.

### 6. Air injection

As pointed out by Hughes and Cole,[11] air in the anterior chamber is well tolerated. We have been using air injections routinely following cyclodialysis for over two years. We have been impressed by the arrest of hemorrhage as soon as the air is introduced into the anterior chamber. Doubtless this is due to the restoration of intraocular pressure, which reduces capillary bleeding. Filtered air is placed in a small Luer or anterior-chamber irrigator to which is attached a slightly flattened lacrimal needle (fig. 10), bent to correspond to the curve of the Elschnig spatula, but only 6 mm. in length. This is introduced as promptly as

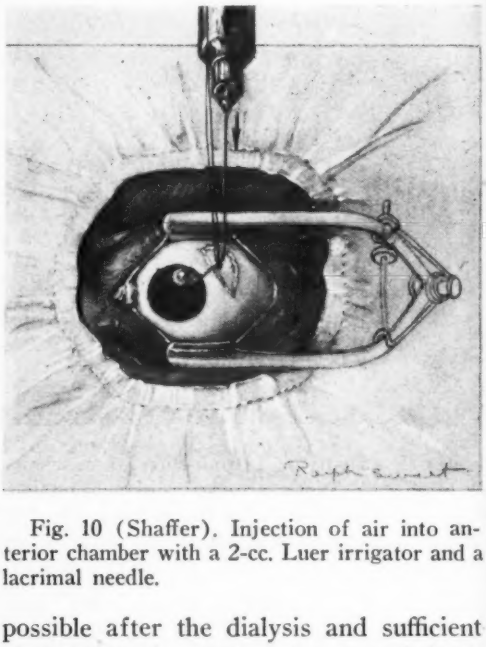

Fig. 10 (Shaffer). Injection of air into anterior chamber with a 2-cc. Luer irrigator and a lacrimal needle.

possible after the dialysis and sufficient air is injected to restore the normal depth of the anterior chamber. In one of our cases the chamber was quite shallow, and in our enthusiasm to ensure an open cleft, too much air was instilled. This produced a deep chamber and increased the intraocular pressure. When the needle was removed, the tangential incision gaped slightly, and a small choroidal herniation appeared, thinned out, and was followed by a small bead of vitreous. Fortunately, a good cleft and a fine functional result were obtained, despite the accident.

### 7. Closure

The conjunctiva is closed with interrupted black silk sutures (fig. 11), which can be removed on the fifth postoperative day.

### 8. Postoperative orders

The patient's head is held with the dialysed portion of the eye upward. The air in the anterior chamber then gravitates up into the cleft, helping to hold it open. At the same time, any blood in the cleft can run out into the dependent part of the chamber.

Medication is used as indicated. If the pupil is large, it is constricted to pull the iris away from the cleft. If it is small, it must be dilated briefly on the second or third day with 2.5-percent neosynephrin to avoid permanent posterior synechiae. Such synechiae must be guarded against for several weeks, as there is almost always a moderate postoperative iritis. In rare instances, this may persist for months.

Gonioscopy, done as soon as the eye is quiet enough to tolerate the procedure, yields information as to the safety of proceeding with mydriatic therapy if an iritis is present. A definite prognosis can usually be given in two or three weeks. If the cleft is shallow or short in extent, the outcome may be doubtful, but a wide, open cleft usually means success. When there is no cleft, the operation has been a definite failure.

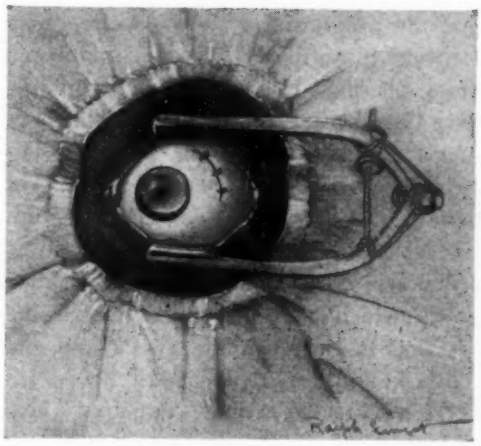

Fig. 11 (Shaffer). Air bubble in the anterior chamber. Conjunctiva closed with black-silk suture.

## Statistics

Our series of 21 inverse cyclodialyses is too small to be of any great statistical value, but each case has been carefully classified and has been followed for six months to two years postoperatively, so

TABLE 1

Statistics in various types of glaucoma

| | Number of Operations | Successes | Percent |
|---|---|---|---|
| Narrow Angle | | | |
| Routine | 18 | 9 | 50 |
| Inverse | 3 | 2 | 66 |
| Wide Angle | | | |
| Routine | 17 | 12 | 70 |
| Inverse | 9 | 8 | 88 |
| Postcataract | | | |
| Routine | 11 | 3 | 27 |
| Inverse | 9 | 6 | 67 |
| Total | | | |
| Routine | 46 | 24 | 52 |
| Inverse | 21 | 16 | 76 |

that the prognosis is quite definite. As a control, 46 similarly classified glaucoma cases, operated by the routine technique, have been used. A cyclodialysis which reduced the tension below 25 mm. Hg (Schiøtz) for one year, or for six months if a good cleft was visible gonioscopically, has arbitrarily been classed as a success. To date none of the inverse group which has been classed as a success has had a secondary rise in tension.

Blaskovics reported a total of 53 inverse cyclodialyses and compared them statistically to 53 similar cases operated by the routine Heine-Elschnig technique. He states that but few of his patients returned for follow-up examinations. His immediate statistics record successful normalization of tension in 67 percent of cases done by his inverse technique, as compared to 48.3 percent successfully operated by the other method. As in our experience, he found the dialysis to be more easily performed, with fewer postoperative complications, such as bleeding, tears in Descemet's membrane, and iridodialysis.

## Summary

Inverse cyclodialysis is the method advocated by Blaskovics of effecting a dialysis by sweeping the Elschnig spatula from the suprachoroidal space into the anterior chamber. Its use, together with air injection, seems to offer a safer and more successful procedure in all cases requiring cyclodialysis. It is of particular value in glaucoma secondary to cataract surgery. Gonioscopic control of the site of operation is essential, if blood vessels and synechiae in the angle, which needlessly add to the complications, are to be avoided. The author's modifications of the original technique are given in detail. A statistical summary of 21 cases is included.

*490 Post Street (2).*

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# THE RELATIVE VALUE OF SEVERAL DIAGNOSTIC TESTS FOR CHRONIC SIMPLE GLAUCOMA*

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The diagnosis of chronic simple glaucoma is established without difficulty when, in a quiet eye, the intraocular pressure is found to be above the normal range, or when advanced signs of glaucoma are present, such as marked excavation of the nerve head, or typical field changes. In such eyes, the course of the disease has usually advanced sufficiently to reveal its presence by the irreversible changes it inevitably produces if uncontrolled. There are, however, patients who consult the ophthalmologist because of ocular symptoms that suggest the presence of chronic simple glaucoma, but who have normal ocular tensions even on repeated examinations. Such patients may show either no functional or anatomic signs of glaucoma, or insufficient evidence for such a diagnosis to be made. The diagnostic challenge such patients present is important, since the absence of definite evidence of chronic simple glaucoma does not eliminate the possibility of that disease being present in a mild or early stage. At such a time proper diagnosis and treatment are urgently necessary to prevent the insidious development of more advanced ocular damage.

Because of the frequent difficulty in detecting early chronic simple glaucoma, many diagnostic procedures have been devised. Since the purpose of these methods generally is to demonstrate the presence of the disease by producing an abnormal increase in the tension of the affected eye, they are often referred to as provocative tests. Our purpose in this investigation was to study the diagnostic value of several of the more commonly employed of these procedures, and to compare their efficacy with that of a new test recently devised. The older diagnostic methods investigated were the dark-room test,[1] the caffeine test,[2] the mydriatic test,[3] the water-drinking test,[4] and the record of the 24-hour ocular tension curve.[5] The newer procedure studied was the so-called lability test recently described by Bloomfield and Lambert.[6]

The eyes to which these tests were applied had each been previously found to have an intraocular pressure of over 30 mm. Hg (Schiøtz), on several occasions. Most of them presented some confirmatory stigmas of glaucoma, such as excavation of the disc and characteristic field changes. When present, such signs were usually early and of mild degree. Gonioscopic examination was not performed on these eyes since our purpose, essentially, was to apply these tests to an average series of eyes with early chronic simple glaucoma, rather than to differentiate the results according to angle depths. At no time had evidence of intraocular inflammation been present in any of these eyes, and the diagnosis of chronic simple glaucoma seemed certain in each case. Eyes that had apparently suffered only acute congestive episodes were not included in this series. None of the eyes studied had undergone any operation, and the tension of each was apparently controlled by the instillation of pilocarpine.

For the purpose of our investigation, the medication of a group of such eyes with known chronic simple glaucoma was discontinued under observation. If the ocular tension rose above normal in any

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eye, the administration of miotics was reinstituted and the patient excluded from this study. However, in many eyes the intraocular pressure remained within normal range, that is, below 30 mm. Hg (Schiøtz), for 24 hours without medication. These eyes were tested, during such an interval of normal tension, with one or more of the diagnostic procedures under investigation. In this way, each experiment simulated the clinical problem of a patient who presents himself with normal ocular tension, but whose history suggests the possible presence of chronic simple glaucoma. This, of course, is the circumstance under which these tests are usually employed. Since each of the eyes in this study had previously shown definite evidence of the disease, the diagnostic value of each of these tests could be evaluated statistically from the number of positive results that occurred in this series. In other words, an ideal test would be positive in 100 percent of these cases.

In reviewing the literature on these diagnostic procedures, it was frequently found that the difference between the normal and abnormal responses to many of these tests was not clearly defined. For the purpose of this investigation it was, therefore, necessary to derive quantitative limits of normality from certain standard textbooks, when such criteria were not presented in the original descriptions of the tests. This seemed proper since these are the tonometric standards most commonly employed by ophthalmologists in the clinical performance of these procedures. For certain of the tests no definite standards whatever were found, and in such cases it was decided that rises in tension must exceed 6 mm. Hg (Schiøtz), to be considered abnormal. It seemed questionable whether lesser elevations could be considered of definite diagnostic significance, in view of the limited accuracy of tonometry.[7] Throughout this investigation, ocular tensions were measured with the Schiøtz tonometer, and recorded in millimeters of mercury in accordance with the chart accompanying that instrument. All the tonometric results that are numerically expressed in the description of the tests that follow, refer to that scale of measurement.

The dark-room test devised by Seidel[1] is performed by measuring the tension of the eye suspected of glaucoma before and immediately after the patient had been seated in a completely dark room for one hour. The occurrence, during this period, of an appreciable rise in tension is usually considered indicative of the presence of chronic simple glaucoma. According to Duke-Elder[8] such a rise must be more than 6 mm. Hg (Schiøtz), in order to be considered of diagnostic significance. In our experiments, 29 eyes in 22 patients, with a definite history of chronic simple glaucoma but with normal tension at the time of our study, were subjected to this test. In five of these eyes, or 17 percent, a rise in tension of more than 6 mm. occurred, to demonstrate the presence of that disease. In the remaining 24 of these eyes, lesser rises occurred to give misleading normal results. During this test, in six of the eyes in this series, or 21 percent, the tension rose over the level of 30 mm., which is usually considered the upper limit of the normal range of tension.[9] The effect of the dark-room test on each eye is recorded in Figure 1.

The caffeine test[2] was performed by having each patient tested drink two large cups of dark black coffee in quick succession. The tension of each eye was measured before the drink was imbibed and thereafter at 15 minute intervals for one hour. According to Duke-Elder,[8] in glaucomatous eyes a rise in tension should occur that may be 15 to 20 mm. Hg (Schiøtz). No actual numerical standard for the normal limit of response to this

test could be found by us in the literature. For the reason previously mentioned it was decided that any rise in tension of more than 6 mm. was abnormal. Eighteen eyes in 13 patients with known chronic simple glaucoma were subjected to this caffeine test. Of these, only one eye, or 6 percent, showed a rise in tension of more than 6 mm. Lesser rises were recorded in six other eyes as shown in Figure 2, which demonstrates the effect of this test on all the eyes in this series. As is indicated, in no eye was the tension elevated above the normal limit of 30 mm. after the ingestion of the caffeine.

The diagnostic value of the mydriatic test[3] was studied by the instillation into the eye of one drop of a 1-percent solution of paredrine three times at 10-minute in-

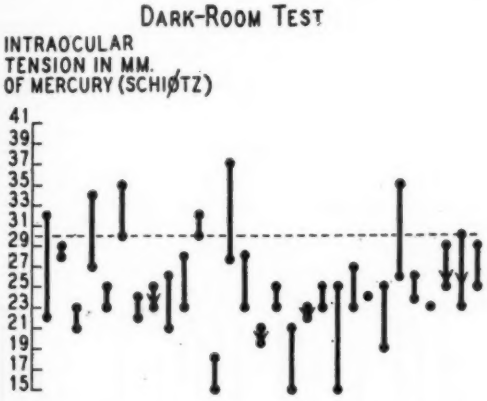


Fig. 1. (Bloomfield and Kellerman). Response to the dark-room test of eyes with chronic simple glaucoma but with normal tension at the time of the test. Each vertical line shows the tension response of a single eye. The lower dot indicates the initial ocular tension and the upper one the height or ceiling to which tension rose. The actual rise in each eye is, therefore, represented by the length of each line. The downward pointing arrow indicates those eyes in which a drop in tension occurred during the period of the test.

tervals. The tension of each eye was measured before the first drop was instilled, and then at half-hour intervals for three hours thereafter. The difference between the highest tension recorded and that present before the mydriatic was administered was considered the diagnostic determinant. Homatropine was not employed

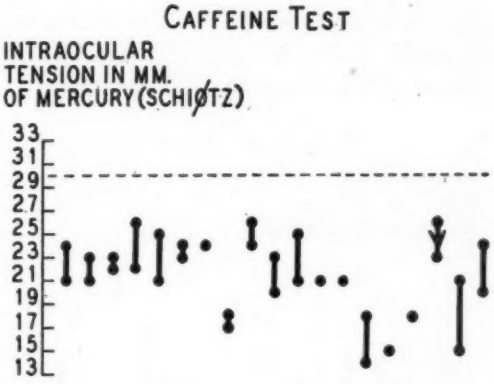


Fig. 2. (Bloomfield and Kellerman). Effect of the caffeine test. Each vertical line represents the change in tension of a single eye with chronic simple glaucoma after the drinking of two cups of strong black coffee. The arrow indicates a drop of tension.

in this investigation since its intense and prolonged action occasionally precipitates acute congestive glaucoma; a condition less likely to be caused by paredrine. Furthermore, Kronfeld, McGarry, and Smith[10] have demonstrated that mydriasis due to homatropine is often not effective in raising the tension of eyes with chronic simple glaucoma of the so-called "wide-angle" variety. Euphthalmine, with which this test had usually been performed previously, was not available because of wartime conditions. According to Duke-Elder,[3] Gradle,[11] and others, no rise in intraocular pressure should be produced by mydriasis in a normal eye, and a measurable increase should be present in eyes with chronic simple glaucoma. Since no quantitative limit to the normal tension response to mydriasis could be found in the literature, we considered any rise in tension of more than 6 mm. to be an abnormal response to this test. Fifteen eyes with chronic simple glaucoma but normal

tensions at the time of our study were tested with mydriasis produced by paredrine, as described. In not one of these eyes did a rise in tension of 6 mm. or more occur. Lesser rises that occurred in 6 of these 15 eyes are indicated in Figure 3, which shows the effect of this test on all the eyes in this series. The dilatation of

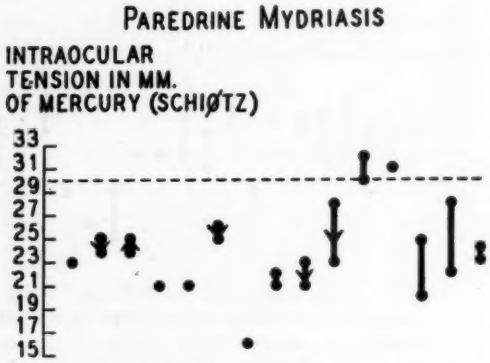


Fig. 3. (Bloomfield and Kellerman). Tension response of eyes with chronic simple glaucoma to mydriasis induced by paredrine.

the pupil that occurred in these eyes varied in degree from moderate to marked. Such tension elevations as were noted did not seem proportionate to the degree of mydriasis present. In only one eye in this group was the tension elevated above the normal limit of 30 mm.

The water-drinking test developed by Marx and applied to the eye by Schmidt[4] was performed by having each patient whose eyes were to be studied, drink a quart of water rapidly, before breakfast. The tension of each eye was measured before the water was drunk, and again at 15-minute intervals for one hour. According to standard descriptions of this test,[8] the tension of eyes with chronic simple glaucoma should rise more than 6 mm. Hg (Schiøtz) during this period. In this way, we tested 22 eyes with chronic simple glaucoma in 12 patients. In 18 of these eyes, or 82 percent, an abnormal rise in tension of more than 6 mm. occurred. In the remaining four eyes, lesser rises were noted. In 17 eyes, or 77 percent, the tension was elevated over the level of 30 mm. The actual tonometric results recorded are presented in Figure 4.

Diurnal variations in intraocular pressure have been shown by Kollner,[5] Hagen,[12] Sallmann and Deutsch,[13] and others to be abnormally large in eyes with chronic simple glaucoma. A difference of over 10 mm. Hg (Schiøtz), between the highest and lowest tonometric readings over the period of study has been suggested to be abnormal by Kollner,[5] Cordes,[14] and Duke-Elder.[8] For our investigation, 12 patients were hospitalized, all medication was discontinued, and the tensions of 20 eyes with chronic simple glaucoma were recorded every 4 hours for a consecutive period of 24 hours. In six eyes in this series or 30 percent, an abnormal fluctuation of more than 10 mm. occurred. In each of the others, lesser variations in tension were noted. The

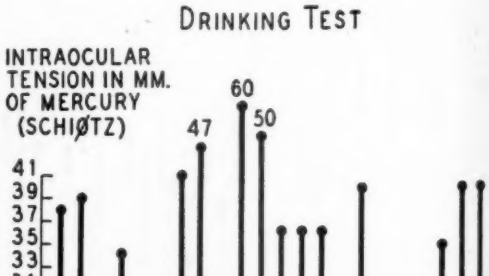


Fig. 4. (Bloomfield and Kellerman). Effect of the water-drinking test on eyes with chronic simple glaucoma.

actual differences between the highest and lowest tonometric reading for each eye during the 24-hour period of observation is presented in Figure 5. In nine eyes, or 45 percent of this group, a rise of tension to a level over 30 mm. was noted during the period of observation.

The lability test devised by Bloomfield and Lambert[6] is a method for measuring the ability of the eye to maintain a relatively stable tension in the presence of sudden transient intraocular hyperemia. The procedure they described is, basically, the simultaneous application of the cold pressor test of Hines and Brown,[15] and the jugular compression test described by Schoenberg.[16]

Bloomfield and Lambert[6] demonstrated that neither of these two procedures alone produced diagnostically significant effects on eyes with chronic simple glaucoma. However, the combination of the two in the lability test proved to be more informative.

The lability test is performed by first measuring the tension of each eye to be tested. A blood-pressure cuff is placed loosely about the patient's neck. The patient then places the open hand in a basin of ice water up to the wrist. Simultaneously, the blood-pressure cuff is inflated to a pressure of 50 to 60 mm. Hg, as read on the attached sphygmomanometer scale. At the end of exactly one minute, the ocular tension is again recorded with the hand still in the ice water, and the cervical pressure undiminished. Thereupon, the hand is withdrawn, the pressure cuff removed, and the test is over, unless a repetition is desired for purposes of accuracy. The tension in all cases returns to its original level immediately.

At this hospital, this procedure has been performed on over 300 patients without serious complaint or undue discomfort. Old patients and hypertensive patients have been subjected to it without a single complication. The test is easily and quickly performed and only a few technical points must be remembered. One is that the water must be ice cold; for that purpose chipped ice is usually placed in the water about a quarter of an hour before use. It is also necessary that the bladder in the pressure cuff be applied anteriorly on the neck so that both jugular veins are compressed simultaneously without protection from surrounding structures. Furthermore, the pressure must be maintained at just below 60 mm. Hg until after the tension is recorded, which should be after precisely one minute. The patient can

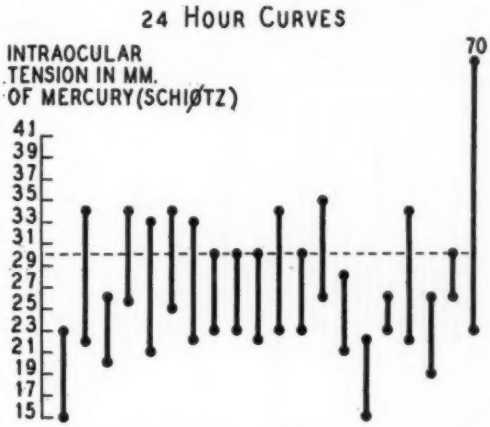


Fig. 5. (Bloomfield and Kellerman). Tension variation, during 24 hours, of eyes with chronic simple glaucoma. The lower dot represents the lowest tonometric reading during this period, and the upper one shows the highest reading. The length of each vertical line, therefore, indicates the amount of variation in tension that occurred in each of these eyes.

breathe quite easily with such pressure about the neck, and, of course, at such levels, arterial circulation is unimpeded. Although some reddening of the face occurs, no real discomfort is experienced by the patient.

In the original description of this lability test,[6] it was shown that if, in any eye, this procedure produced a rise in ocular tension of more than 9 mm. Hg (Schiøtz), the diagnosis of chronic simple glaucoma was strongly suggested. However, if the height or ceiling to which the ocular tension rose exceeded the normal limit of 30 mm. whether or not the actual rise exceeded 9 mm., such a diagnosis was even more conclusively indicated. On the basis of these standards, in only 1 of

77 nonglaucomatous eyes was a distinctly abnormal result recorded by this test; while in almost every eye with chronic simple glaucoma that was tested at that time positive responses were obtained. These diagnostically significant responses resulted from tests applied only to eyes with chronic simple glaucoma. There is some evidence to suggest that eyes that have suffered acute congestive glaucoma may not display an abnormal lability of ocular tension by this method when they have recovered from an attack and are in a quiescent phase.[17]

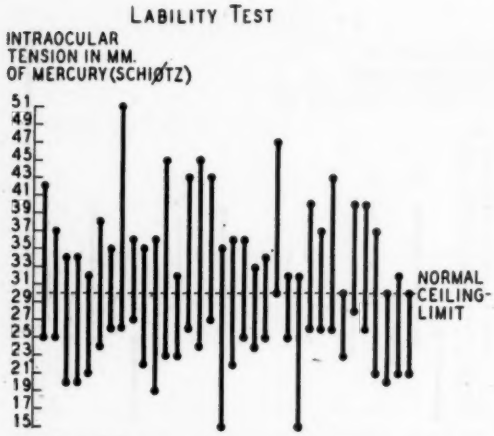


Fig. 6. (Bloomfield and Kellerman). Tension response induced by the lability test when applied to eyes with chronic simple glaucoma.

To determine further the diagnostic value of the lability test, it was applied in our investigation to a series of 34 eyes in 24 patients with definite histories of chronic simple glaucoma, but with normal tensions at the time of our experiment, exactly as had been done in the study of the other diagnostic procedures. In 31 of these eyes, or 91 percent, rises in tension occurred that were 9 mm. or more. When the height or ceiling to which the tension rose in each eye was employed as a standard of response, as is preferred, it was found again that in 31 of these 34 eyes, or 91 percent it had risen above the normal limit of 30 mm. In the case of the other three eyes in this group, the ceiling or height of tension reached was exactly 30 mm. which would be considered suggestive but not definitely indicative of the presence of chronic simple glaucoma. All these results are shown in Figure 6 in which the actual rise in tension and the ceiling reached in each eye is indicated. In no performance of the lability test in this series was undue discomfort or any complication noted.

Two or more of these six diagnostic procedures were applied to many of these eyes. This afforded the opportunity to compare directly the diagnostic efficacy of these tests when applied to the same glaucomatous eye with normal tension. In Figures 7 and 8 are shown the rises in tension that occurred when three or more tests were applied at different times to each of 24 eyes. It is apparent that in a large majority of these eyes, the lability and water-drinking tests produced a markedly greater rise in tension than did any of the other diagnostic procedures. This observation indicates that in addition to their greater diagnostic reliability as previously demonstrated, these tests produce an abnormal response in eyes with chronic simple glaucoma that is usually more distinctly appreciable than that of the other tests studied.

## Comment

In evaluating a diagnostic test, the primary consideration is its reliability in demonstrating the presence of the disease for which it was devised. Secondary considerations affecting the practical value of any test are its simplicity of interpretation and its ease of performance.

A prime necessity for a dependable test is, of course, the establishment of reliable criteria to differentiate normal responses from abnormal ones. It was not the purpose of this study to determine such standards for any of these tests, but rather

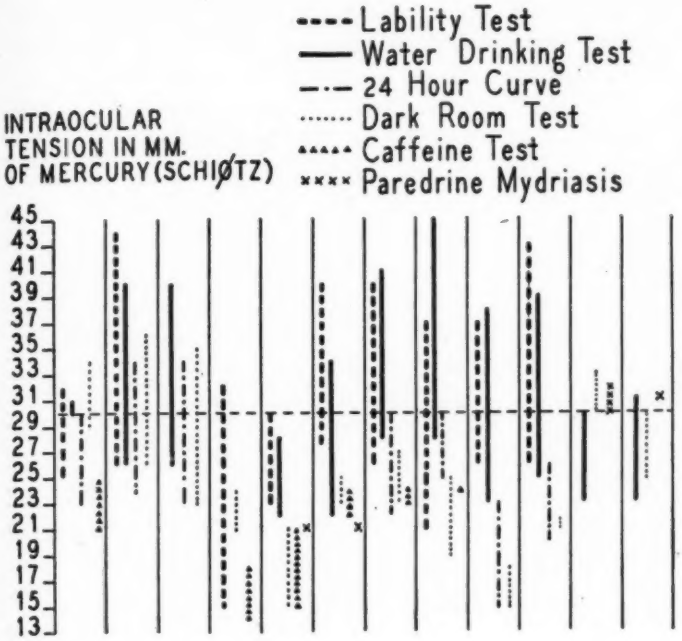


Fig. 7. (Bloomfield and Kellerman). Graphic presentation of the effect of various tests when applied to the same eyes. Each compartment represents one eye and the tension rises shown were produced in that eye by the different tests as indicated in the accompanying legend. As in the previous figures, the bottom of each vertical line is the initial tension and the top of the line indicates the height to which the tension rose in response to that particular test.

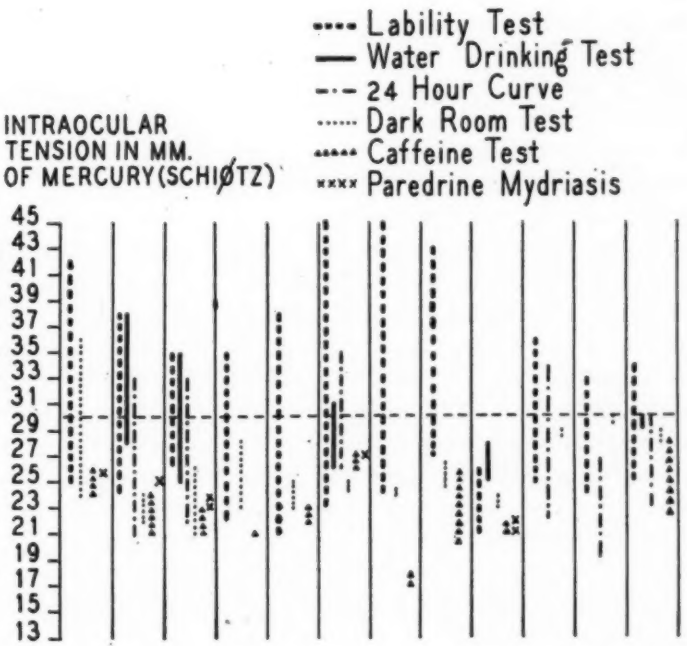


Fig. 8. (Bloomfield and Kellerman). Continuation of Figure 7, further demonstrating the effects of different tests on individual eyes with chronic simple glaucoma.

to ascertain the reliability of these different procedures, using the standards most often employed in their clinical application. The poor results obtained in certain of these tests, therefore, may be due to the common use of faulty criteria in their interpretation rather than to the actual unworthiness of the procedures themselves. In any case, however, it is important to be aware of the misleading information that such tests may yield, in their present form.

It may be noted that the results of provocative tests are generally interpreted according to the rise in tension that they produce in any eye. To explore the possibility of applying a single standard to all of them, the actual height or ceiling to which the tension rose in these eyes during each test was noted. Since 30 mm. Hg (Schiøtz) is generally accepted as the upper limit of normal intraocular pressure,[9] any elevation in tension above this level, no matter how produced, might be considered indicative of glaucoma. This concept of a normal ceiling for variations in a homeostatic system was described by Hines and Brown[15] in their elucidation of the cold-pressor test for essential hypertension, and was adopted by Bloomfield and Lambert[6] as a standard for the lability test. As is shown in the charts for each test studied here, the eyes in which abnormally high rises in tension occurred were usually, although not always, the ones in which intraocular pressure was elevated to abnormal levels; that is, over 30 mm. Hg (Schiøtz). Of even greater interest is the fact that the number of positive results obtained with each of these tests on these glaucomatous eyes was approximately the same whether the standard of abnormality was the span of fluctuation in tension that occurred, or the elevated level of tension or ceiling reached in each case. In other words, the reliability of each of these tests appears to be approximately the same no matter which of these two criteria is employed in its interpretation.

Our investigation has shown that the so-called lability test whose effect is produced by the induction of a transient intraocular hyperemia is the most reliable of the diagnostic procedures studied. It should be pointed out that this result applies only to eyes with chronic simple glaucoma, since no eye was studied that had either secondary glaucoma or recurrent episodes of acute congestive glaucoma followed by periods of apparently normal tension. The water-drinking test proved to be almost as trustworthy as the lability test. The 24-hour study of ocular-tension variations proved of decidedly less diagnostic value in these eyes with known chronic simple glaucoma. This suggests either that the 24-hour curve of tension variations is not as reliable an indicator of the disease as is usually supposed, or that the standards usually employed for its evaluation are at fault. The dark-room test proved to be of questionable diagnostic value. The response to the caffeine test and to the mydriasis produced by paredrine indicated that no diagnostic significance could be attached to these two procedures.

Another important consideration in evaluating the diagnostic worth of any clinical procedure is the ease of interpretation of its results. It is obvious that however consistently a test might produce rises in tension in eyes with chronic simple glaucoma, if such increases were often so small as to be attributable to the limited accuracy of tonometry, they might frequently be overlooked and the results of the test incorrectly evaluated. It was for this reason that in studying these procedures an elevation of at least 6 mm. of Hg (Schiøtz) was postulated as necessary for positive diagnostic significance, and that a greater rise was considered even more desirable. In Figures 7 and 8, it is demonstrated that the elevations in tension produced by the lability test, and by the water-drinking test to a lesser degree, are generally significantly greater than those produced by the other procedures considered.

Of lesser importance, but worthy of consideration, is the ease of performance of each of these tests. The lability test requires no unusual apparatus, and is by far the quickest, since it can be performed

in a little over one minute. This speed of performance permits a repetition of the test in a relatively short period, if desired, for purposes of accuracy. The other diagnostic procedures here considered all require much longer periods of time for their performance, as described. The water-drinking test, which is the only one that approaches the lability test in reliability and degree of response evoked, requires that the patient be tested before breakfast, and that tonometric readings be taken for one hour. The inconvenience of such a procedure emphasizes the general superiority of the lability test as a diagnostic method for the early detection of chronic simple glaucoma.

## Summary

Six tests commonly employed for the diagnosis of chronic simple glaucoma were applied to a series of eyes with that disease but with normal tension, at the time of this study, although medication had been interrupted.

The presence of chronic simple glaucoma was demonstrated in these eyes most consistently by the lability test of Bloomfield and Lambert, closely followed in reliability by the water-drinking test.

In decreasing order the diurnal tension curve, the dark-room test, the caffeine test, and the response to mydriasis induced by paredrine, proved much less dependable.

The lability test also produced the most appreciable tension responses in these eyes, and seemed the quickest and most convenient procedure to perform.

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# LIPIODOL STUDIES OF CHRONIC DACRYOCYSTITIS

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Functionally the lacrimal drainage system is an elaborate mechanism. Normal tear conduction depends on: (1) lids with their mucous glands that are normal in position and function; (2) atmospheric pressure and humidity for partial evaporation of tears; (3) massage action of the orbicularis; (4) capillarity to draw tears from the lacus lacrimalis into the canaliculi; (5) vacuum-created suction to carry tears into the sac; (6) gravity to draw tears into the inferior nasal meatus, and so forth.

Anatomically, normal tear conduction depends on the integrity of a potential channel of almost microscopic caliber possessing a number of sharp angulations. The anatomy of this system is familiar to all ophthalmologists and requires no elaboration, but it should be recalled here that, although the lacrimal sac and duct are potential cavities, actually they are mere slits whose lumina merge imperceptibly both anatomically and histologically. There is not much difference in the size of the two lumina, so that they comprise one continuous functioning tube—normally. However, this tube is lined with a delicate muscosa which is constantly exposed to infection to which it all too frequently succumbs. The lower end of this tube, the nasal duct, is especially vulnerable and likely to upset the whole delicate drainage mechanism. This has been known for a long time. For while contraction and malposition of the puncta, stricture and obstruction of the canaliculi, descending infections from the conjunctival sac, and many other factors may play a part, by far the most commonly cited cause of chronic dacryocystitis in the adult is an ascending infection from the nose.

Fuchs[1] states: "The immediate cause of a chronic dacryocystitis is stricture of the nasal duct. . . . The constriction . . . develops, as a rule, in consequence of affections of the nasal cavity." De Schweinitz[2] says: "In the majority of cases, blennorrhea of the sac is caused by a retention of the secretion on account of stricture or obstruction in the nasal duct, and the participation of the lining of the sac in an inflammation of the nasopharynx." Parsons,[3] while not so overwhelming in his indictment, also states that: "Chronic dacryocystitis is commonly attributed to the effects of stricture of the nasal duct. . . . Obstruction to the lower end of the nasal duct may be caused by the pressure of nasal polypi, an hypertrophied inferior nasal turbinate bone, extreme deviation of the septum, and so on." Collins and Mayou[4] state unequivocally that: "Inflammation of the lacrymal sac (dacryocystitis) is always accompanied by obstruction of the duct. . . . The common causes of lacrymal obstruction. . . . are . . . in adults, —inflammatory affections of the mucous lining spreading from the nose."

In a recent comprehensive review of the whole subject Garfin[5] comes to the conclusion that: "Dacryocystitis is contingent on stenosis of the nasolacrimal duct, either congenital or acquired, plus a secondary infection. The opinion of the majority of authors cited is that the etiological factor is usually to be found in the nose in the form of an acute or chronic inflammation or in disease of the sinuses. Trauma, physical or surgical, and infectious diseases of the nose may also play a part in the causation of dacryocystitis."

## REPORT ON LIPIODOL STUDIES

The X-ray studies shown here are of interest because they present in graphic detail visible testimony of the effect of

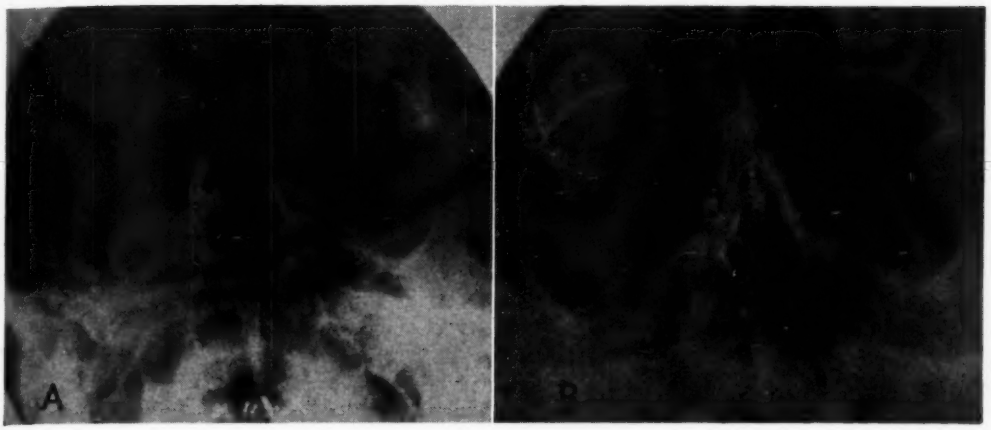

Fig. 1 (Fox). a, Early nontraumatic, chronic dacryocystitis before sac dilatation. b, Same case 16 months after dacryocystorhinostomy showing free passage of lipiodol into nose.

chronic inflammation and trauma on the nasolacrimal drainage channels. They were obtained by injecting the sacs in various types of chronic dacryocystitis with lipiodol before the X-ray studies were made. These photographs have been selected from a large series and are typical of the common findings.

### Technique

The technique of lipiodol injection into the lacrimal sac is simplicity itself. An ampule of lipiodol is placed in warm water for a few minutes. The sac to be injected is thoroughly irrigated and gently massaged to assure its emptiness. The lipiodol is drawn up into a small syringe and injected through a lacrimal needle into the sac in the usual manner of sac irrigation until the lipiodol is seen to flow back into the conjunctival sac. Excess lipiodol is then wiped out of the conjunctival sac and X-ray plates, a-p and lateral, are taken within a half hour of injection.

In order to simplify presentation and discussion the cases have been divided into three groups.

### Nonspecific chronic dacryocystitis

Figures 1 and 2 are typical cases of the nonspecific type of chronic dacryocystitis commonly seen by ophthalmologists. The sac in Figure 1a and the smaller sac in Figure 2 are early cases before distention has occurred. Both are good illustrations of an approximately normal sized sac soon after obstruction has occurred. The larger sac in Figure 2, on the other hand, is a six-months-old case in which a mucocele is already present. Figure 2 is interesting because it shows a bilateral case, the mucocele being the result of a persisting chronic inflammation, while the smaller sac has been obstructed for only 21 days. It shows strikingly what a lasting

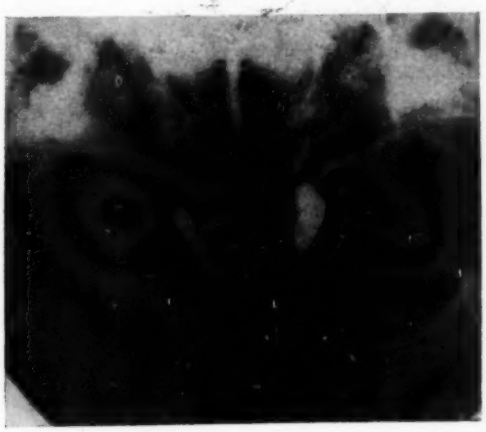

Fig. 2 (Fox). Bilateral, chronic dacryocystitis. Larger sac has been involved for six months; smaller sac for only three weeks.

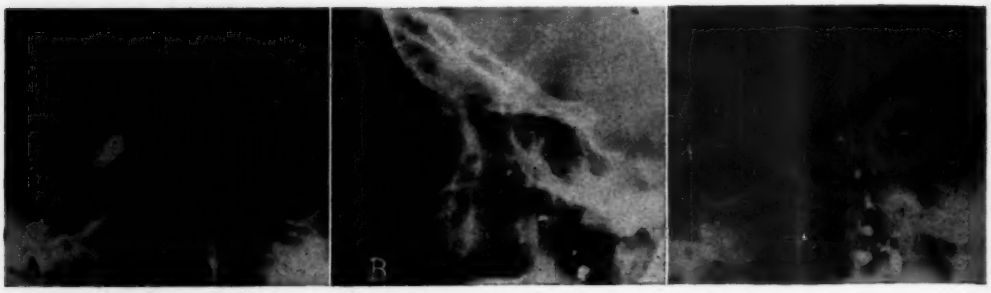

Fig. 3 (Fox). a, Traumatic dacryocystitis with huge mucocele nine months after bullet wound of left orbit with point of exit behind left ear. b, Same in lateral view showing forward bulging and dilatation. c, Same following dacryocystorhinostomy (negative has been reversed). There was no direct trauma to the sac.

inflammation does to the nasal sac.

Note that in all three sacs the obstruction starts at the upper end of the duct and that all three are narrower above near the dome and wider below. This is typical.

### Traumatic chronic dacryocystitis with intact sac

Among recent war casualties, many cases of chronic dacryocystitis were seen which were the result of trauma to the eyes and other tissues surrounding the lacrimal sac and duct. This included trauma to the inner half of the lids, especially the lower punctum, the nose, the ipsilateral sinuses, the jaw, and the lacrimal passages themselves; in other words, any type of trauma to the lacrimal passages or the adjacent tissues which would interfere with normal tear conduction and lead to lacrimal stasis and its ensuing syndrome.

Despite the difference in initiating etiology the sacs in Figures 3, 4a, and 5 all show mucocele formation not unlike that seen in Figure 2 and the reason for this is that the sac always reacts to obstruction in the same way. In such cases the inflammation and infection are usually consequent to stasis and not the causative factor, but the intact sac behaves similarly in both conditions and gives the same ul-

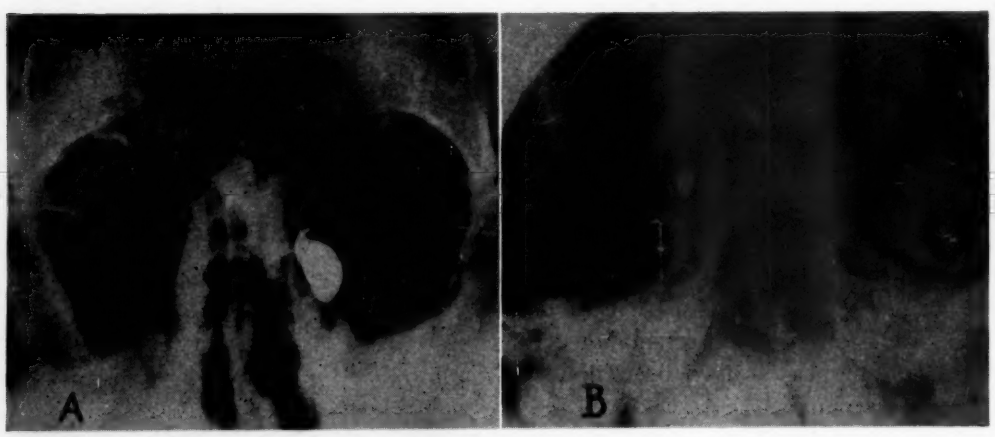

Fig. 4 (Fox). Bilateral, traumatic, chronic dacryocystitis seven months after injury by bullet which entered the left angle of the jaw and came out through the right orbit causing fractures of the facial bones and both orbits. a, Mucocele of intact sac indistinguishable from that of the non-traumatic type. b, Small sac with absent dome due to direct injury and consequent strictures. Bony destruction was so severe that rhinostomy was impossible and bilateral cystectomy was performed.

timate clinical picture; that is, obstruction of the duct end, dilatation, and final mucocele formation (figs. 2 and 4a).

### Traumatic chronic dacryocystitis with sac involvement

Where there has been trauma to the sac the X-ray picture is entirely different. Thus, Figures 4b, 6, 7, 8, and 9 show sacs radically different in outline from the others. The most striking differentiating feature is that all these sacs are *smaller* than normal (figs. 1a and 2). Furthermore, they are all misshapen, showing irregular outlines due to strictures in and around the sac and consequent reduction of contents. Figure 4 is an interesting case of bilateral traumatic chronic dacryocystitis, with Figure 4a showing an intact sac indistinguishable from the nonspecific type. The sac in Figure 4b, however, was *directly* involved in the same injury and shows it by reduction of the lumen and a missing dome. In Figure 6, the sac is not only small but is wider above. This is contrary to the usual picture seen in the untraumatized sac. Figure 7 shows a tiny residual functioning sac cavity into which lipiodol was injected with some difficulty. Figure 8 shows a similar sac only slightly larger. The functioning portion of both these sacs is below the canthal ligament, the dome being obliterated. Figure 9, on the other hand, shows only the upper portion of the sac to be functioning and even this is not free of adhesions, as may be seen. All these abnormal manifestations are due to adhesions in and adjacent to the sac. Also, here as in all other cases, the duct is not visible.

Fig. 5 (Fox). Traumatic, chronic dacryocystitis 9½ months after shell fragment wound involving both antra. Note distention and convolution of intact sac and its relation to lid edges outlined with lipiodol. Patency was maintained for a while as shown by the free passage of lipiodol into the nose. It was finally necessary to resort to surgery.

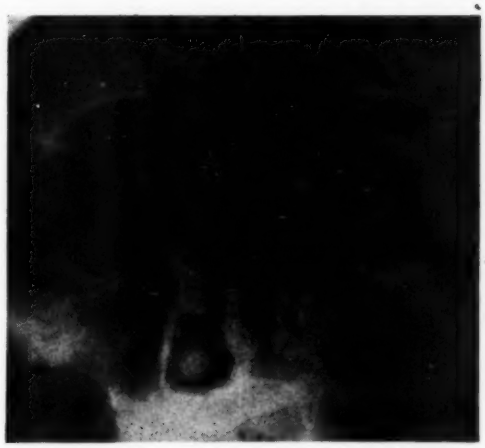

Fig. 6 (Fox). Traumatic, chronic dacryocystitis seven months after jeep accident in which the patient sustained fractures of the nasal bones and direct trauma to the sac. Note that the sac is small as compared with those shown in Figures 3, 4a, and 5, and that the upper part of the sac is wider than the lower portion. This is contrary to the usual picture in nontraumatic dacryocystitis.

### Discussion

These X-ray findings seem to corroborate what has been previously known about the cause of chronic dacryocystitis and are compatible with our knowledge of the anatomy and physiology of the nasolacrimal drainage system. The nasolacrimal sac normally holds about 2 cc. of fluid, a capacity which is more than adequate for the transmission of the 0.3 to 0.5 cc. of tears normally secreted per day. Not only that, but the sac is quite elastic

Fig. 7 (Fox). Traumatic, chronic dacryocystitis with sac involvement four months after shell-fragment injury of nose and antrum. Most of the sac lumen is obliterated with only a small part of the lower portion left patent as seen by relation to lid edges marked out with lipiodol. This was enough to give a purulent dacryocystitis and extirpation of the sac remnant was required preceding plastic surgery.

and, being covered anteriorly and laterally by yielding tissue, is easily distended by internal pressure to hold five times this amount, if necessary. This happens frequently as shown above. On the other hand, the nasal duct which is only about 15 mm. long runs in a bony canal formed by the maxilla, the lacrimal bone, and the lacrimal process of the inferior turbinate. This allows for but little, if any, distention.

Another anatomic fact noted by Wolff[6] furnishes an additional reason for this being the common site of the obstruction. The sac itself slopes gently outward, while the duct inclines somewhat inward. Hence, at the point of junction there is a slight but definite angulation as well as constriction, and it is here that the obstruction usually occurs. In other words, this is the beginning of the narrow, indistensible portion of the channel and usually the highest point of obstruction. This has been corroborated by Halle[7] and others. In addition, Schaeffer[8] states that the lumen of the nasolacrimal duct is frequently irregular and tortuous and not infrequently shows outpouchings and diverticula, all predisposing to stasis and consequent stricture. Jacod,[9] as well as others, has pointed out that the thinness of the wall between the lacrimal passages and an infected ethmoidal sinus makes the former quite vulnerable to such infection. Thus, given an ascending infection from the nose or sinuses with a consequent involvement of the nasolacrimal mucosa, the duct, having no room to distend, will soon become clogged up and strictures will rapidly develop. Even in the early cases shown in Figures 1a and 2, the duct is already closed. The sac, however, will be dilated with mucopurulent secretions from the infected mucosa and retained tears, the walls will become thickened, and the result will be the usual mucocele of chronic dacryocystitis. This is why probing, unless done very early, is so rarely successful.

When the sac has suffered no trauma, it will always be found to be narrower at the dome and wider below (figs. 1, 2, and 4a). The reason is this: Although the chronically infected sac is closed at both ends, the upper fundus portion is covered by the internal canthal ligament which is

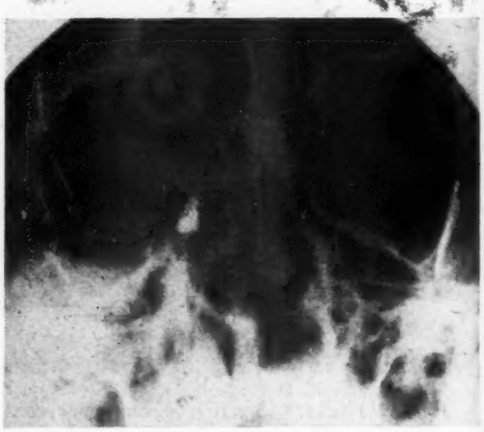

Fig. 8 (Fox). Traumatic, chronic dacryocystitis with sac involvement 14 months after injury to bridge of nose. Note the irregularity of the sac outline and absence of the dome as compared with Figures 1 and 2.

a tough inelastic fibrous tissue allowing for but little distention. The portion of the sac below the internal canthal ligament, however, is covered only by a few fibers of the orbicularis and this area is the first to distend because there is little resistance here. This is also why most of the abscesses and fistulas of the sac break through at this point. A possible subsidiary cause may be the fact that the upper part of the sac has an outlet through the canaliculi into the conjunctival sac, and the pressure at the dome is thus relieved. However, this is probably a negligible factor.

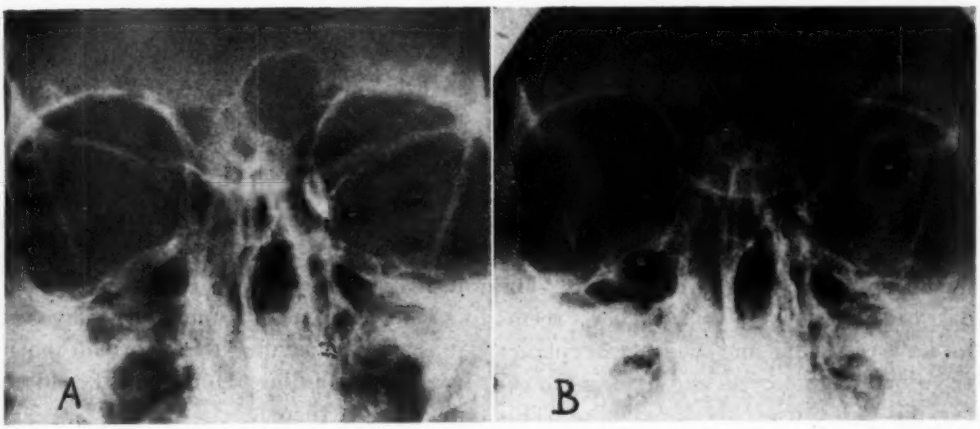


Fig. 9 (Fox). a, Traumatic, chronic dacryocystitis following injury to nose 25 months previously. The small amount of lipiodol retained and the absence of the lower half of the sac are due to strictures. Note the normal relation of the canaliculi to the sac as outlined by the lipiodol. b, Patency of the lacrimal channel following dacryocystorhinostomy.

It will also be seen that, in all these cases where the sac is intact, the dilatation is forward and not backward, note especially Figure 3b, because of the unyielding posterior bony wall. Sometimes the sac becomes so dilated as to show convolutions. Figure 5 shows such a case in which partial atresia was relieved for a while by probing. Finally, however, surgery was necessary to relieve the obstruction.

When there has been direct trauma to the sac or the closely adjoining tissues, all types of bizarre pictures are possible, depending only on where the trauma is. It has been shown above that in such cases the sac is always smaller than normal and irregular in outline. In fact, the sac lumen may be so reduced as to be almost absent (fig. 7). Despite this, even these cases develop a chronic dacryocystitis, which has to be reckoned with if surgery of the neighboring tissues is contemplated. For, as long as there is any uninjured mucosa left and as long as the connection through the canaliculi remains patent, pus is formed and finds its way into the conjunctival sac. Even in these cases, if there is not too much bony destruction, dacryocystorhinostomy is sometimes worth trying. Figure 9b shows the successful result following operation on such a sac.

The value of X-ray studies of the lipiodol-filled sac in all cases of chronic dacryocystitis is obvious. It not only helps the ophthalmologist to diagnose the type of case with which he is dealing and to ascertain the point of obstruction, but it also shows him what he will find when surgery is carried out. Even better, it will help him to decide whether or not surgery should be undertaken. (In cases such as

shown in Figure 7, for instance, one would hesitate to undertake a dacryocystorhinostomy.) This is a diagnostic procedure which should be used in all cases of chronic dacryocystitis.

There is no intention here to go into detailed discussion of the therapy of chronic dacryocystitis. Early cases without permanent stricture may respond to irrigation and medication or even probing. In cases of long standing, all these measures will usually be unsuccessful. The X-ray studies presented here show that, unless a sac has sustained trauma, it is usually dilated and needs no probing. The duct runs in such a narrow channel and fibrous tissue is laid down so early that probing is usually a painful, useless procedure.

At various times successful results have been reported with the use of setons, cannulae, and grafts of various sorts. The dacryocystorhinostomy, however, seems to have received the widest acceptance from ophthalmologists and it seems to offer the best prognosis for a cure. This point is stressed because it has been stated[10] that, with complete atony of the sac, tears will not be carried into the nose even if the duct becames pervious. The lipiodol studies shown here prove that any case of chronic dacryocystitis which has lasted for any length of time develops a dilated and frequently atonic sac. Despite this rhinostomy is successful in the majority of uncomplicated cases.

## Conclusions

Most authorities agree that the common cause of nonspecific chronic dacryocystitis is an ascending infection from the nose or paranasal sinuses causing obstruction of the lacrimal duct. The X-ray studies reported here tend to confirm this.

The lacrimal sac in these cases becomes dilated and atonic when the infection is persistent. The dilatation is always forward and greater below the internal canthal ligament. The sac may become so dilated as to show convolutions.

The same characteristic X-ray picture is seen in cases of chronic dacryocystitis where the sac has become obstructed due to trauma to neighboring tissues but is itself intact.

When the sac is traumatically involved, it is always smaller than normal and irregular in outline. Here also the duct is always obstructed.

An X-ray study of the lipiodol-injected sac is a valuable diagnostic procedure and is of special importance when surgery is contemplated.

I am indebted to Dr. Jacob Reber for his invaluable assistance in this work.

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# FACTORS IN THE DIAGNOSIS OF ANISEIKONIA AND PAIRED MADDOX-ROD TESTS*

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There are 21 aniseikonia clinics in the United States. In our general population, as many as two-million persons may have complaints correctable by aniseikonic glasses,[1] which would otherwise remain unrelieved. This means that about five percent of those wearing glasses would be benefited by aniseikonic correction.

It may be years before enough refractionists obtain the instruments and acquire the experience necessary to prescribe successfully for this condition. In the meantime, it is important for the refractionist to recognize which of his patients he should refer for aniseikonic study. Unfortunately, no simple screening device has been available, which will positively rule out aniseikonia. The following pages were written in the hope of promoting interest and understanding of some of the problems of handling aniseikonic patients, and to present what bases there are for diagnosis without the use of the standard instruments.

In lieu of aniseikonic correction, many refractionists today rely on altering the subjective monocular refractive prescription to relieve the complaints of patients with severe phoria, high anisometropia, or high astigmatism. Correction for aniseikonia in such patients, however, gives the higher acuity of full correction, with the comforts of stereopsis and high fusional amplitudes.[2]

## IMPORTANCE OF BINOCULAR REFRACTION

Although the patient is to receive a screening and not a prescription test for aniseikonia, the refraction must be done with the utmost care. The aniseikonic patient is more critical, has high visual acuity in most cases, and not only notices slight changes in the prescription, but may complain bitterly.

There has been emphasis on "balancing the accommodative state" of the two eyes. This is a confusing phrase, because in all normal situations, the accommodation balances itself. Accommodative impulses wherever their origin are distributed equally so that both eyes accommodate equally and synchronously. It is better to say that the refractive lenses over the two eyes should be balanced so that the object and both retinal images are in conjugate focus at any given distance. This has been done by use of the stigmatoscopy refractive method,[3,4] which has been in use for the past 20 years. All who have used it find it convenient and accurate. The device was present on the original ophthalmo-eikonometers, and all of these instruments are still in use, in spite of subsequent "improved" models on which it was deleted for reasons of economy.

Two other methods of binocular refraction are in use: "Sensitometry," by Luckiesh and Moss, Cleveland;[5] and the "Leland Polaroid Refractor" by Van Wien, Chicago.[6] The "sensitometry" method is unusual because it uses, as a criterion of focus, not visual acuity but the brightness contrast threshold. This method is highly interesting and deserves more attention. The Leland polaroid refractor is an ingenious device which permits both eyes to see the test objects dimly with intermittent bright illumination visible only to the eye being tested. Both eyes maintain central, as well as peripheral, fixation and concomitant movement, ensuring binocular vision.

* From the Dartmouth Eye Institute.

In ordinary methods of refraction, errors occur due to poor control of binocular conditions. For instance, one will retinoscope a hyperope, add more and more plus until suddenly all the plus must be removed. This is not ciliary spasm. The patient is fixing a distant target with both eyes. When plus spheres are added to one eye, both eyes relax accommodation until the fixation target is blurred, when the other uncorrected eye takes over. This eye was in focus for infinity, and must accommodate sharply to focus on 20 feet. Since both eyes accommodate equally, the retinoscopist is surprised to find that he has added too much plus, and must start over.

The chief advantage of binocular noncycloplegic refraction is that the test is done under normal working conditions, avoiding peripheral corneal and lenticular aberrations. The test need not be repeated to make sure the patient will consent to wear the prescribed lens combination. The accommodative level is adapted to convergence at all distances so that at no distance will one eye begin to blur. An eye which is less free to accommodate exactly on the fixation point is slightly blurred, and is inhibited in its fusional movements.[7] If it happens to be the dominant eye, the patient may be seriously handicapped. In exophoria, a binocular refraction results in a prescription more minus for distance. In esophoria, the result is more plus for near. A nonpresbyopic patient with exophoria will find the full monocular correction blurs his vision for distance, due to excess accommodation from convergence stimulus.

It is important to fix the axes of high oblique astigmatism under binocular conditions, because of the high probability of cyclophoria in such patients. The astigmatic axis determined monocularly may be from 3 to 7 degrees different in each eye from that determined under binocular conditions when the eyes both rotate from the position of rest to maintain fusion.

H. Culbertson, in 1888,[8] would adjust the cylinder axes in oblique astigmatism binocularly until the appearance of slanting floors or leaning walls was corrected. G. C. Savage[9] described methods of changing the axis of astigmatism derived monocularly to an axis which would relieve the strain on weak oblique muscles. Dr. Savage went so far as to prescribe weak oblique cylinders for this purpose in the absence of astigmatism.

This binocular adjustment of cylinder axes may be done with paired Maddox rods. Place a base-down prism over one eye in the phoropter or phorometer. Adjust both Maddox rods at exactly 90 degrees to produce two horizontal lines from one muscle light. If the lines appear horizontal and parallel to the patient, there is no cyclophoria. If not, one can gradually rotate one or both cylinders to make each line horizontal and parallel. In practice, this may require a greater axis change than seems reasonable.

A more conservative method is that suggested by the Leland-Van Wien technique. Blur the vision of one eye to 20/40 with a dark glass. The contours of the large letters and the chart edges will maintain concomitant rotations. Then test the cylinder axis on the unblurred eye in the usual way with the Jackson crossed cylinder on a line lower than is visible to the blurred eye. Check the binocular acuity to make sure the cylinder axes have not been changed too much.

### Clinical factors suggesting aniseikonia

Aniseikonia may be suspected in all patients not relieved by other means, or in patients with inadequate stereopsis. Aniseikonia is common in those corrected for anisometropia, oblique astigmatism, or high ametropia. Patients with phoria

and intermittent tropia may have aniseikonia. Aniseikonic patients are usually doing work of a type which makes critical demands upon binocular vision. In children and students, aniseikonic glasses are prescribed frequently for fusion or reading difficulties.

The most frequent complaint is headache following reading or near work. Patients may complain that long rides or the movies will produce eye strain, headache, vertigo, or nausea. Some have discovered that closure of one eye for certain tasks will reduce symptoms. Headache may be severe enough to be called migraine, and is commonly of many years' duration. There may be photophobia and asthenopia alone.

The patient with aniseikonia frequently does not know that his binocular space judgments are distorted. To detect such distortion, one must eliminate all monocular clues for depth localization such as known size, parallax, perspective, overlay, object movement, and so forth. This is effected in the space-eikonometer test for aniseikonia (fig. 1). Precision in this test is entirely from stereopsis, wherein the small differences between the retinal images of the two eyes which occur because the visual field is seen from slightly different points of view, can be appreciated physiologically. Changing the magnification of the image of one eye will change the relative differences between the images in the two eyes, and one would therefore expect a change in subjective localization of all objects in view. This is found to be true of objects whose configuration does not lend itself to monocular depth localization.

This binocular distortion can be demonstrated to one with normal eyes as follows: Place an afocal magnifier before one eye consisting of trial-case lenses (−5.00D. cyl. ax. 90° ⊃ +5.00D. cyl. ax. 90°) displaced about 1 cm. apart. Observe a person with his arms outstretched laterally, and note that one arm is several inches longer than the other. When his arms are stretched anteriorly, the other arm has become longer. At the same instant, any windows, furniture, or other background detail will appear perfectly normal and symmetrical. Evidently one is using monocular clues on the background at the same time one is using binocular clues on the person's arms. This must be selective suppression of parts of an image.

If a normal person were to wear this

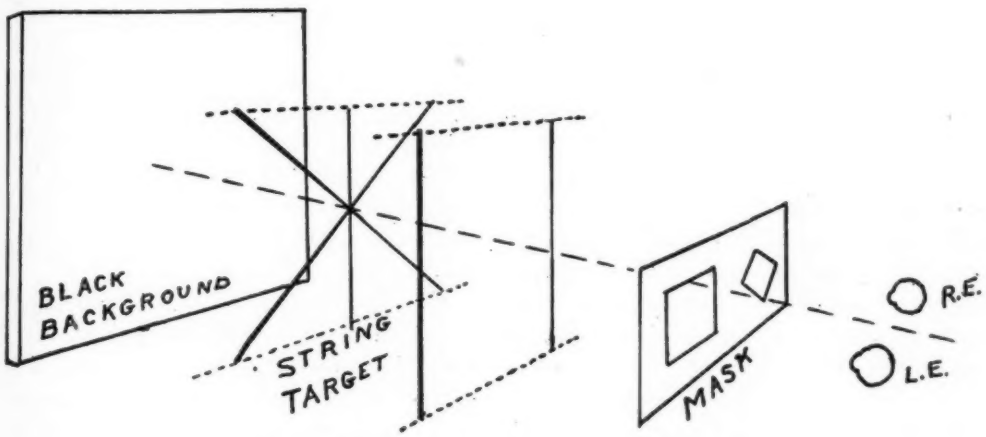


Fig. 1 (Miles). The space-eikonometer test for aniseikonia.

lens combination over one eye for a few days, this distortion would become less evident for most ordinary views, because the conflict between monocular and binocular clues is easily won by the monocular. The patient with aniseikonia, according to theory, is unable to suppress properly, and will therefore develop eye strain. When the nervous mechanism controlling eye movements and accommodation is presented with two different sets of stimuli which differ considerably, the normal oscillation of accommodation and extraocular muscle tone is disturbed. Theoretically, this is a cause of phoria.

I was able to wear a 3-percent, axis 180°, aniseikonic lens over one eye for 4 weeks, then a 4-percent, axis 180°, lens over the other eye for 5 weeks without great discomfort. The initial distortion disappeared in 4 days. On wearing oblique aniseikonic glasses for 4 weeks: R.E., 2-percent, axis 45°; L.E., 2-percent, axis 135°, I had constant, mild eye strain and more persistent distortion. It took much practice to relearn such a game as badminton, while wearing these lenses. Twice daily tests on the space eikonometer and on the ophthalmo-eikonometer showed no tendency for an adaptive process.[10]

Monocular occlusion is valuable in the diagnosis and treatment of aniseikonia.[11] Unfortunately in some adult patients, occlusion is annoying, and is often not sufficiently complete, continuous, and prolonged to do any good.

One patient (D. E. S., a woman, aged 47 years) was given an opaque contact lens for one eye, and was comfortable for several months. A small perforation of the enamel admitted an unnoticed beam of light, leading to a difficult-to-explain recurrence of her complaint. When the perforation was finally found and covered, she again became comfortable.

Another patient (W. R., a man, aged 32 years) required less occlusion. He had never been able to play tennis or baseball because of inability to follow a small moving object. A movie would give him such a headache that he would have to go to bed for 24 hours. He had had six refractions in 10 years without receiving wearable glasses. He found that a pair prescribed for his cousin did help him somewhat. He had moderate oblique bilateral astigmatism, which was corrected on one eye by the cousin's glasses and which, in addition, blurred the other eye to 20/70. He found aniseikonic correction relatively comfortable, and obtained stereopsis.

Aniseikonia is obviously impossible in a person with a totally blind eye, but it occurs in rare instances in those with a central scotoma. Defects in peripheral fusion may cause discomfort, as pointed out by Burian.[20] However, since aniseikonia cannot be measured when the visual acuity is poor (20/50 or less), other treatment is indicated.

Patients are frequently seen with high corrected anisometropia and perfect comfort. Certainly, in such patients, it is best to leave well enough alone even if one eye is to suppress and eventually become amblyopic. If they are among those actually aniseikonic, they usually show defective stereopsis when tested on the space eikonometer.

For most occupations, binocular vision is not essential. Other factors being equal, a monocular individual drives a car as safely as a binocular. In fact, in close work, monocular workers are found more efficient and subject to less fatigue than binocular. However, any intelligent, cooperative child under the age of 12 years should be urged to develop acuity, fusion, and stereopsis.

To measure stereopsis, stereoscope cards are quite inadequate. Patients may measure 100 percent and not have enough stereopsis to make judgments on the

space eikonometer, and vice versa. The Howard-Dohlman test and the Verhoeff stereoptor are said not to repeat with precision, because the targets subtend too small a visual angle.[12] Experience on the space eikonometer shows that stereopsis used to determine the position in space of an X-shaped string cross, movable about its center so that the top and bottom or either side may alternately approach the observer,[13] must be of higher caliber than that necessary to pass the Howard-Dohlman or Verhoeff tests. Many with good judgment on the latter cannot, at least without practice, detect movements of the string cross.

Aniseikonia will solve many anisometropia problems. Some advise a full prescription to obtain high acuity, and tell the patient he must "get used" to the glasses. Others undercorrect, gaining comfort at the expense of acuity. It is likely that those patients who "get used" to such glasses either suppress or have axial ametropia, in which case there is no aniseikonia. In axial ametropia (that not due to curves of cornea or lens), the retinal-image size remains the same whether the eye is myopic or hyperopic, when the correcting lens is placed at the anterior focal point or 15 mm. from the cornea (Knapp's law). If the ametropia is lenticular or corneal, aniseikonia should be proportional to the anisometropia.

In anisometropia, the ocular image behind the more minus of the two refractive lenses is likely to be smaller, and for proper fusion needs magnification. In most of such patients the measured aniseikonia is about 1.5-percent magnification per diopter of anisometropia, at an ordinary eye-wire distance. However, an important group have aniseikonia measured on the "wrong" eye. For instance, if a patient wears: R.E., +1D. sph.; L.E., +4D. sph., one would expect him to require about 3- to 4-percent magnification of the image of the right eye. In some patients, it might be measured over the left, or perhaps, not found.

It has been said that aniseikonic correction for an anisometropic patient may give him comfort by the simpler means of correcting the prismatic imbalance at the various angles of gaze. To refute this, is the large group of patients successfully treated in which the aniseikonia was prescribed over the "wrong eye," increasing any prismatic imbalance introduced by the anisometropia. The use of slab-off prism to correct prismatic imbalance in the reading position is logical, and does suffice for many patients.

A comparison of 100 patients treated successfully for aniseikonia with 100 patients apparently unable to wear aniseikonic glasses was made recently.[14] Of the 200 patients there were 69 in whom the measured aniseikonia was about 1.5 times the dioptric difference in the two eyes, and was measured over the more myopic of the two eyes. Of these 69, 44 were among the success cases, and 25 were among the failure cases. Of the cases in which agreement of the measured with the estimated aniseikonia was in one meridian only, 29 were among the success cases, and 28 were among the failure cases. Of the cases not in agreement, 27 were among the success cases, and 47 among the failure cases.

This suggests that one is justified in prescribing aniseikonic lenses magnifying the image of the eye corrected for more hyperopia only when the measurement is satisfactory and repeatable with precision, and when temporary size fitovers are reported comfortable.

Aniseikonia may appear in patients due to facial asymmetry. There are many patients with slight unilateral enophthalmos, and so many with one eye higher than the other, that the headrest design for the new space eikonometers has been changed to adapt to such differences. Sup-

TABLE 1

NEGATIVE MAGNIFICATION PRODUCED BY TRIAL-CASE MINUS CYLINDERS
MM. REAR SURFACE TO CORNEA

| Diopters Cylinder | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .12 | .13 | .14 | .16 | .17 | .18 | .19 | .20 | .21 | .22 | .23 | .25 | .26 | .27 | .28 | .29 | .30 | .32 | .33 | .34 | .35 | .37 | .38 | .39 |
| .25 | .18 | .20 | .23 | .26 | .28 | .30 | .33 | .36 | .39 | .41 | .44 | .46 | .49 | .52 | .54 | .57 | .60 | .62 | .65 | .67 | .70 | .73 | .76 |
| .50 | .37 | .42 | .46 | .52 | .57 | .61 | .67 | .71 | .77 | .81 | .86 | .91 | .96 | 1.01 | 1.06 | 1.11 | 1.16 | 1.21 | 1.26 | 1.30 | 1.36 | 1.41 | 1.46 |
| .75 | .55 | .62 | .69 | .77 | .85 | .92 | 1.00 | 1.07 | 1.15 | 1.22 | 1.29 | 1.37 | 1.45 | 1.42 | 1.60 | 1.67 | 1.74 | 1.82 | 1.89 | 1.97 | 2.04 | 2.12 | 2.20 |
| 1.00 | .69 | .79 | .89 | .99 | 1.09 | 1.19 | 1.29 | 1.39 | 1.49 | 1.59 | 1.69 | 1.79 | 1.89 | 1.99 | 2.09 | 2.19 | 2.29 | 2.39 | 2.49 | 2.59 | 2.69 | 2.79 | 2.89 |
| 1.25 | .89 | 1.01 | 1.13 | 1.25 | 1.37 | 1.49 | 1.61 | 1.73 | 1.86 | 1.97 | 2.10 | 2.22 | 2.34 | 2.46 | 2.58 | 2.70 | 2.82 | 2.94 | 3.06 | 3.18 | 3.29 | 3.41 | 3.53 |
| 1.50 | 1.05 | 1.19 | 1.34 | 1.48 | 1.63 | 1.78 | 1.92 | 2.06 | 2.21 | 2.36 | 2.50 | 2.64 | 2.79 | 2.94 | 3.08 | 3.23 | 3.38 | 3.51 | 3.66 | 3.81 | 3.95 | 4.09 | 4.24 |
| 1.75 | 1.24 | 1.41 | 1.57 | 1.73 | 1.90 | 2.07 | 2.23 | 2.40 | 2.57 | 2.73 | 2.90 | 3.06 | 3.23 | 3.39 | 3.55 | 3.72 | 3.89 | 4.05 | 4.22 | 4.38 | 4.54 | 4.70 | 4.87 |
| 2.00 | 1.46 | 1.65 | 1.84 | 2.02 | 2.21 | 2.40 | 2.59 | 2.77 | 2.96 | 3.14 | 3.33 | 3.51 | 3.70 | 3.88 | 4.07 | 4.25 | 4.44 | 4.62 | 4.80 | 4.98 | 5.16 | 5.35 | 5.53 |

pose a 4-diopter bilateral hyperope has 2 mm. difference in eye-wire distance (cornea to eye-wire plane). He might have complaint from the 0.80-percent aniseikonia introduced. Geometrically, there is 0.1 percent of aniseikonia per diopter in the refractive lens per millimeter it is changed in eye-wire distance. Table 1 gives the minification of a number of trial-case minus cylinders in the power meridian at various eye-wire distances. (Such lenses must have plano front surfaces, or the curves will magnify and neutralize the minification at 0.25 diopters and smaller.) If a patient with the correction: R.E., +1D. sph.; L.E., +4D. sph., has measured aniseikonia of 2 percent in the right eye, it could be corrected in three ways. First, decrease the left sphere from a +4D. to +2D. Second, place the right lens at an eye-wire distance of 17 mm.; and the left one at a distance of 7 mm. (see table 1). Third, make the thickness and base curve high on the right lens, and low on the left lens. In simple prescriptions, this can sometimes be done by selecting proper Tillyer series lenses directly from stock, lowering the cost.

Aniseikonia may occur in emmetropic or isometropic eyes. At a naval station in 1942, 280 nearly emmetropic trainees were examined for aniseikonia. One was found to have 1-percent aniseikonia, eight had 0.75 percent, and 32 had 0.50 percent. Five cases with severe complaints relieved by afocal aniseikonic glasses occur in the Dartmouth Institute records.

### ASTIGMATISM AND ANISEIKONIA

Astigmatism, being primarily corneal, is not commonly axial, and is therefore not subject to Knapp's law. In other words, astigmatism, if asymmetrical, should produce proportional aniseikonia. The experimental data tends to support this.[16, 17] There is some variation in ob-

lique aniseikonia attributed to cyclophoria which interferes with the space-eikonometer test.

Oblique aniseikonia, an inevitable result of oblique astigmatism, results functionally in tipping of vertical contours in space. When a vertical line is viewed through a minus cylinder, the line appears to rotate, following the rotation of the cylinder. If cylinders (always minus in this paper) are placed before both eyes and rotated converging the axes down, a vertical line viewed by the right eye will appear to rotate clockwise, and that viewed by the left eye counterclockwise. Although the eyeballs may rotate and the images fuse, from the center of the lines as a reference point, there will be uncrossed disparity above, and crossed disparity below. The result is that the fused line will tip away from the observer at the top and toward him at the bottom. The same effect is true of a wall, of a floor, or a table top. Making the cylinders converge above will reverse the effect.

Aniseikonic meridional lenses placed similarly before both eyes will have an identical effect without producing the blur that cylinders cause. These lenses are usually spoken of in the plus, or magnifying axis. Therefore, the correction of aniseikonia caused by converging-up high cylinders is accomplished by positive meridional magnifiers placed in axes likewise converging up. If the astigmatic axes converge down so should the axes of the correcting magnification.

Oblique aniseikonia is measured in terms of the sum of the arc degrees that each of the axes of these aniseikonic lenses must be converged up or down to correct the distortion of vertical lines in space in the target of the space eikonometer. Axes converging up is called plus, and down is called minus.

When all vertical lines are removed from the target, the X-shaped cross will not tip in space with oblique cylinders, or with oblique meridional-size lenses. Oblique aniseikonia due to the equivalent of: R.E., −2D. cyl. ax. 45° (or 135°); and L.E., −2D. cyl. ax. 135° (or 45°) or more, is considered likely to require optical correction in most patients.

### Maddox-rod test for aniseikonia

There are means available to the refractionist by which, in his own office, he can test for aniseikonia by its effect on space perception. This can be done in 10 minutes on the space eikonometer. The same target could easily be set up by a handy man. Requiring even less equipment, however, is the Maddox-rod test, which has not previously been described.

The set up may consist of several flashlight bulbs with push pins, wire, and transformer, arranged so that the lights can be placed in various positions on a dull-black fiberboard background centered near the eye level of a seated patient, perpendicular to his line of vision. Any set of trial-case minus cylinders which have plano front surfaces would be satisfactory.

Place the Maddox rods as in Figure 2(a) to obtain a binocular image of two vertical streaks from two small "muscle lights." The streaks will appear at unequal distances from the observer, if axis-90° aniseikonia is present, just as in the space-eikonometer target[13] (fig. 1). Axis-180° aniseikonia is estimated as in Figure 2(b) where there are three lights, one in the center of each line drawn. Black-tape masks on each Maddox rod produce the target as shown.

If the upper-half lines are not level, aniseikonia is present, just as in the ophthalmo-eikonometer target.[18] In the more detailed directions to follow, the measurements of target distance and visual angle given may be varied for convenience, but are known to give comparable results

with the standard techniques when a 4-foot board and a 6-foot working distance are used. The target lights should not subtend the same angle as the blind spot and the visual axis. If patients have poor stereopsis or fixation, use absolute darkness and dim target lights. In most cases, a small light behind the patient will not interfere.

Place the refractive prescription in the trial frame or phoropter so that any sphere over the right eye is at the same eye-wire distance from any sphere over the left eye. If the trial case carries no 0.00 lenses, simply add 0.12D. to both sides. For instance, in the prescription: R.E., +1D. sph. ⌒ −0.50D. cyl. ax. 180°. L.E., 0.00, place in the trial frame: R.E., +1.12D. sph. ⌒ −0.62D. cyl. ax. 180°; L.E., +0.12D. sph. ⌒ −0.12D. cyl. ax. 180° to balance the amount of glass on both sides. Theoretically the central thickness of all lenses used should be equal, because of the magnification factor due to thickness. The Maddox rods can be placed anywhere in the frame, but the images are larger and more sensitive when they are nearest the eyes. However, when masks are used to test axis-180° aniseikonia, the farther the Maddox rods are from the eyes, the greater the precision. Maddox rods as high as 2½ inches in diameter are made, and would make a large target. Center the pupils on the central axes of the lenses, and adjust the corneal alignment to equalize the eye-wire distances.

To measure axis-190° aniseikonia, pin two target lights on the central horizontal line of the board, 14 inches apart, equidistant from the patient's eyes. Then place the Maddox rods in the trial frame so that two parallel, vertical lines are seen by each eye. Take care that the lines are fused. Place a minus cylinder axis 90° lens out in front of the trial frame before one eye, and ask the patient which of the two vertical lines seems nearer to the eyes. The line on the same side as the eye over which the cylinder is placed will appear nearer than before. If there is inequality, vary the power of the cylinder used, until a lens is found which will equalize the distances of each vertical line. Place this lens in the front cell. Refer to Table 1 to determine its axis-90° aniseikonia. Test the sensitivity by finding the smallest lens that will displace the lines equally when held alternately before the two eyes. This lens may be a −0.12D. cylinder in one with normal stereopsis.

Some aniseikonic patients arrive at a point where the lines appear equidistant, but will see movement with a given cylinder placed over one eye when there is no movement with the same cylinder placed over the other eye. In the eikonometers, there is no analogous problem,

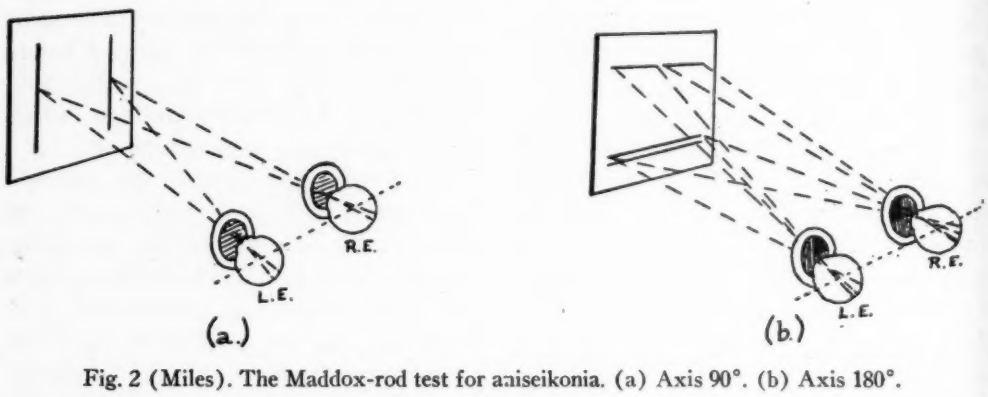


Fig. 2 (Miles). The Maddox-rod test for aniseikonia. (a) Axis 90°. (b) Axis 180°.

as sensitivity is tested by enlarging or minifying the image seen by one eye alone. If the right eye happens to be the one involved, the space-eikonometer test now in use simply registers poor axis-90° sensitivity and an unsatisfactory prescription. A. Ames, Jr., explains that there is habitual suppression in the eye which is not sensitive. This is presumably the mechanism by which stereopsis impulses are surpressed in the normal eye, as in the experiment early in this paper where one arm is seen to be shorter than the other. The background part of the image of one eye is suppressed axis 90°.

To test a patient for axis-180° aniseikonia takes more time, and requires "fussy" technique. Three lights are pinned on the vertical central line of the board, about 20 inches apart, with the extra light 2 inches below the lower one. Black tape is placed over the upper inner quadrant of each Maddox rod, when they are placed to produce horizontal lines. The two lower lines are fused below, while the upper one is divided by the masks into halves. The two tips should be completely separated about 2 inches. There is a tendency for the eyes to converge and diverge on this target in a dark room, due to absence of any vertical object for binocular fixation. If the masks are properly placed (they must cover more than one quadrant), the tips of the upper lines can be made to approach and recede by the patient manipulating the interpupillary distance knob, while the test is going on. Do not let the tips touch, or there is no sensitivity at all. Keep the head at the proper elevation. It may help to draw a picture.

One patient tested (R. B., a boy, aged 18 years) had intermittent exotropia of 30 diopters, but was not handicapped by this variability. His sensitivity on the test was ± 0.5-percent magnification, which is comparable to that shown by him on the space eikonometer.

If the left half line, seen by the left eye, appears higher, place a cylinder axis 180° before it of such power that the two half lines appear level. Then test the sensitivity as before with a small cylinder-held axis 180°. Hyperphoria will interfere with sensitivity, and must be corrected. A prism placed in the system does not have to be balanced on the other eye because no curved surface is involved.

In hyperphoria, there is error in this test due to fixation disparity. Therefore, if it is present, invert the target described above for axis 180°, and place the masks on the lower inner quadrants of the Maddox rods. Repeat the above tests, and take the average. Transpose the power and eye-wire distance of the cylinder required into aniseikonia by use of Table 1. Since the table gives minification, the amount should be transferred to the other eye and called magnification to conform to custom.

An analogous method will test axis-90° aniseikonia in patients who have stereopsis too deficient for the method described above. If the patient has pin-point pupils, there will be little sensitivity with the mask tests until the pupils are dilated. Axis-45° or 135° (oblique) aniseikonia cannot be measured by the Maddox-rod method. A mosaic Maddox rod has been made which by producing two lines at right angles could duplicate the target of the space eikonometer. However, since one would need a trial set of aniseikonic lenses, it would be better to set up a string target.

The fusion pattern in the Maddox-rod, axis-180° test is two lines instead of one in order to improve the accuracy of peripheral fusional movements. In this target, the peripheral retina is used. If the visual angle of the elements is too great, judgment is based on images seen with poor acuity. When the angle is too small, the special effect of aniseikonia on the target elements is too small for precision.

The standard space-eikonometer target subtends 9 arc degrees at 10 feet, and the ophthalmo-eikonometer target subtends 4 arc degrees at 20 feet. The space-eikonometer test for 13 inches gives comparable results to those at 10 feet, but similar tests on the ophthalmo-eikonometer for near show wide variations. The "normal" exophoria for near may account for this finding. It is assumed that aniseikonia does not vary with the distance.

Minus cylinders can be used instead of aniseikonic, afocal trial lenses in the Maddox-rod test, because the targets used consist of parallel lines in the same axis as that of the cylinder used. There is no blurring. It can easily be shown on the space-eikonometer, axis-90° target that the subjective aniseikonia measured for various minus cylinders axis 90° up to 2 diopters before one eye produces a straight line graph which corresponds closely to the actual magnification of each cylinder as shown in Table 1. Above 2 diopters accommodation interferes with the test by blurring the lines.

An aniseikonic, trial-lens set would contribute to accuracy in the Maddox-rod test because the lenses would not have to be placed in the precise eye-wire distance that minus cylinders require. Whereas, a minus cylinder will double in aniseikonic magnification in the range between 9 and 22 mm. eye-wire distance, the aniseikonic trial lens will vary insignificantly.

It is obvious from Table 1 that, in measuring and prescribing aniseikonia, all refractive and measuring lenses in the trial frame during measurement must be placed at known distances from the cornea. Otherwise, magnification differences between the eyes cannot be calculated. This fact has discredited all screening devices attempted in the past.

Patients with anomalous retinal correspondence cannot be tested on aniseikonia instruments, because of the extramacular fixation. Anomalous fixation is preferred even though normal macular visual acuity is present in the deviating eye. To remove the features of the target objectionable to the cerebral macular fusion centers, all peripheral detail in the visual field must be eliminated. This is not effected in any of the ocular-testing devices in common use. Ordinary retinal images are too complex to fuse in these patients, so the less critical anomalous retinal center is used.[19]

A patient (R. B., a boy, aged 10 years) was found to have sometimes normal and sometimes abnormal correspondence on the after-image test. Invariably he showed abnormal correspondence on the synoptophore. In a darkened room free from peripheral fusion contours of any kind he used normal correspondence. On the space eikonometer, he saw the target without apparent suppression or diplopia, but was insensitive to aniseikonic changes. On a similar target produced by Maddox rods in a totally dark room, he was sensitive to changes of ±1 percent, axis 90°.

### Other experiments with paired Maddox rods

Place Maddox rods over each eye as in the test for cyclophoria, with a base-down prism over one eye. Set the lines horizontal and parallel, and remove the trial frame carefully. Hold it so that by moving the head up and down, the observer can exert vertical eye movements while looking at the single target light. On looking up, the patient should see the lines converge on the right (incyclophoria), and on looking down, the opposite. These rotary eye movements are best seen at 20 inches, due to the increased stretch and leverage of the oblique muscles during convergence.

Put the trial frame on the patient, adjust the lines parallel, and demonstrate that minus cylinders with axes converging up will make the parallel lines appear converged on the right. Likewise, making

the axes converge down the lines appear converged left. Most persons can detect this change with −0.25-diopter cylinders. Now, presuming the prism could be removed from the trial frame without changing the setting, the lines could be fused. Such fusional movement produced by minus cylinders converging up would be incyclovergence, and vice versa.

In testing cyclofusional amplitudes, there is a great difference in results depending on the target used. For instance, in using a printed page, cyclofusional amplitudes are surprisingly high, possibly 15 degrees, when tested at the reading distance. When using two vertical lines produced by two Maddox rods, the rotation of the rods necessary to cause doubling may be as high as 10 degrees, compared to about 4 degrees when the lines are seen horizontally. When the lines are seen vertically, and are rotated equally in opposite directions, each eyeball rotates slowly with its line, keeping the fused lines in the sagittal plane but tipped. Due to the phenomenon of stereopsis in horizontally disparate points on the "X," the crossed disparate points are seen as a more distant part of the line using the center of the "X" as the point of reference. This maintenance of fusion requires cyclofusional ocular movements which are very slow, often one second of time per degree rotation of the lines. If only one Maddox rod is turned, the resulting innervations for cyclofusional movements are distributed equally between the two eyes,[21] and both will turn through equal arcs as long as fusion holds. In this case, the fused line rotates subjectively on a frontal plane as well as on the saggital plane, and the measured amplitude is only about two-thirds the amount measured if the Maddox rods are rotated equally.

Suppose the patient observes fused vertical lines produced by two Maddox rods, and adjusts the rods so that the fused line appears vertical in both the saggital and frontal planes. Suppose the reading of the Maddox-rod marks on the trial-frame axis scales are not both 90°, but one is 88° and one is 92°. Two conditions might cause such an error: cyclophoria and oblique aniseikonia. Cyclophoria can be partially corrected in patients with astigmatism or meridional aniseikonia by proper lenses.

There is an interesting test for stereopsis using Maddox rods. It is astonishing at first sight, because the cause is not immediately evident. Place two lights on the board 6 inches apart on an oblique line about 45 degrees from the horizontal in either direction. Place the Maddox rods to make a pair of vertical fused lines. Then slight rotary movements of one or both of the rods will make the lines appear to advance and recede alternately from the observer for several inches.

Another test with binocular Maddox rods has some theoretical significance in regard to the horopter, and possibly in regard to phorias and fixation disparity. Place three lights on the central horizontal line equidistant, and observe them from a point equidistant from the lateral two. Place Maddox rods over both eyes, so that three fused vertical lines are in view. Some observers will see the center line in front of the plane of the other two, while others may say it is behind. The latter is "normal," at a 6-foot distance. Rare individuals have a tremendous error, which is not merely poor stereopsis.

The phenomenon could be due to the variations of the normal asymmetry in space value of the elements of the nasal and temporal halves of the retina. Given any three vertical lines on a frontal plane, with monocular vision, a normal person will not be able to place the center line exactly equidistant to the other two lines. Using the right eye, some persons will place the center line slightly nearer the right line, and others will place it consistently nearer the left. The error

is often in opposite directions in the two eyes, but is sometimes the same. If two such figures were drawn, and presented in a stereoscope before the two eyes for fusion, the center line would be off the plane of the outer two because of its disparity.

Phenomena of rivalry between the two retinas are readily and strikingly shown by Maddox-rod targets. Pin several lights on the board in an oblique line. In the trial frame, place the Maddox rods with their axes converging so that the binocular view is a field of oblique lines at right angles. After a few minutes staring at this target, a normal person notices a constantly changing patchy disappearance of parts of the pattern. The more lights, the more active the patchy suppression becomes. Any movement of one Maddox rod will cause the other eye to suppress completely for a moment (as in the major amblyoscope). A prism placed before one eye will likewise cause the other eye to suppress.

## Conclusion

Present beliefs of the author on factors in the diagnosis of aniseikonia are outlined in a simple manner in the hope of making it easier for the profession to get a foothold in this advanced field. Any patient may have aniseikonia who is not given comfortable vision and stereopsis by the usual procedures, especially when they have anisometropia, high ametropia, or oblique astigmatism.

Tests for stereoscopic acuity are discussed. Those in common use are said to be inadequate because the target angle subtended is too small and the target consists only of vertical and not oblique lines.

Binocular noncycloplegic methods of refraction receive attention. Patients with high oblique astigmatism should be corrected by cylinders at an axis determined when the eyes are fixed on the same point, with enough peripheral detail present binocularly to prevent rotational incomitance.

A method of measuring aniseikonia with paired Maddox rods is described, and various practical matters discussed. This and other Maddox-rod tests are offered for the purpose of teaching and for practical office use.

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# DETACHMENT OF THE CHOROID AND THE RETINA

## Anatomic and other considerations in the differential diagnosis

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The differential diagnosis between detachment of the choroid and serous separation of the retina, the presence of an intraocular tumor or retinal cyst having been ruled out, is, according to Duke-Elder,[1] ordinarily not difficult, "the solid appearance of the choroidal detachment, its smooth surface (not wavy or mobile as in retinal detachment), and the appearance of normal retinal vessels with their color unchanged, being sufficiently apparent points of differentiation." Shallow or empty anterior chamber, folds in Descemet's membrane, and hypotony occurring in postoperative cataract and glaucoma cases led O'Brien[2] to suspect detachment of the choroid. Verhoeff[3] goes further, stating that, given the above characteristic ophthalmoscopic findings and Hagen's[4] sign of exaggerated translucency on transillumination, "the diagnosis is certain" and knowledge of previous wound leakage or obliterated anterior chamber is not essential for the diagnosis.

However, the diagnosis is not always easily made, as witness the case reported by Spaeth and DeLong,[5] of what appeared at first to be choroidal detachment following shortly after corneoscleral trephination. Six months later with the finding of impaired transillumination after cataract extraction, the case was considered to be one of old, stationary retinal detachment due to an unrecognized neoplasm. Since no tumor cells were present in the xanthochromic, viscous "subretinal" fluid obtained by transscleral diathermy punctures, which resulted in reattachment, the final diagnosis was that of unresolved subchoroidal hemorrhage dating from the trephining operation. The case of Verhoeff and Waite,[3] which was proved by microscopic examination to be one of spontaneous detachment of the choroid, had been originally diagnosed as separation of the retina.

The ophthalmoscopic picture may be further confused by the coexistence of choroidal and retinal detachment. However, except in those eyes badly damaged by plastic or suppurative iridocyclitis and severe trauma, this condition appears to be very rare, and choroidal detachment seems to be the primary lesion. A search of the literature reveals only seven cases,

although others may have been observed but unreported.

Duke-Elder[1] states that retinal detachment does not follow postoperative choroidal detachment, but may complicate unexplained or spontaneous cases, while Meller[6] mentions retinal separation as complicating both delayed postoperative (type 2) and spontaneous (type 3) choroidal detachments. Hudson[7] in his examination of 574 eyes found 153 cases of choroidal detachment. In only one of these was there coexisting myopic separation of the retina. Simon[8] observed the combined conditions in a case of cyclic albuminuria. Elschnig's[9] case was that of a middle-aged man in whom the choroidal detachment was assumed to be primary and the retinal separation to be secondary. Recovery followed aspiration of the subchoroidal fluid.

Purtscher[10] reported a case, due to diffuse episcleritis and serous tenonitis, in which he considered the choroidal detachment and complicating retinal separation to be a collateral edema; and the reattachment occurred after subsidence of the tenonitis. In Ziporkes's[11] interesting case, there were undulating folds in the temporal retina and a choroidal detachment in the extreme upper temporal periphery associated with a mixed tumor of the lacrimal gland. Following removal of the tumor, both the folds and the detachment subsided.

Extensive retinal separation following choroidal detachment, which developed after combined intracapsular extraction, has been observed by Kirby[12] in a patient afflicted with osteochrondrodystrophy and general maldevelopment, and complete reattachment was obtained by extensive surface and penetrating diathermy and trephine-drainage openings.

In Case 11 of the series of Spaeth and DeLong[5] choroidal detachment developed after the removal of steel wire from the vitreous via the anterior route, subsided spontaneously, and was followed three months later by retinal separation in the same area. Full recovery followed operation. The choroidal detachment was considered to be the result of trauma and a surgical procedure, and the retinal separation was probably due to uveitis set up by the original damage to the choroid.

Another case, that reported by Nelson[13] as total retinal detachment following intracapsular cataract extraction with spontaneous reattachment after an acute attack of glaucoma, is worthy of note. Both the present writer and his associate, Dr. K. H. Chapman, had previously interpreted the detachment as choroidal, not retinal.

## Case report

In view of the rarity of spontaneous reattachment of serous retinal separation and the even greater infrequency of retinal detachment complicating choroidal detachment, it would seem proper and of some interest to record my observations in the case reported by Nelson[13] and to use it to illustrate some features which may prove helpful in the differential diagnosis.

*Mr. H. T. W.*, aged 79 years, was first seen by me on October 20, 1942, giving the history of gradually failing vision in the left eye for the past 12 years, and in the right eye for two years. He had suffered a blow on the left eye, cutting the globe, some indefinite time ago, but apparently no visual damage resulted. He had seen another oculist the previous July or August and was given some drops for the right eye, which he did not use for very long. The patient was obviously senile, and the family commented that he was hard to handle. An attack of blindness following an abdominal operation in 1925 was not mentioned.

The vision of the right eye was reduced to counting fingers at one meter in

the temporal field; that of the left, to light perception and full projection. The right eye was in a state of well-advanced, chronic, simple glaucoma. The macula appeared finely pigmented and slightly edematous, and many drusenlike spots were grouped around the posterior fundus. A hypermature cataract was present in the left eye. Otherwise the eye appeared normal. Tension was: R.E., 30 mm., Hg (new Schiøtz); and L.E., 18 mm. Hg. Testing of the right visual field revealed an irregular, absolute central scotoma of about 8 degrees in diameter and contraction of the upper nasal field to within 20 degrees of fixation for a 1-degree form on the Ferree-Rand perimeter. The diagnosis was: R.E., advanced, chronic, simple glaucoma and senile macular degeneration or central angiospastic retinopathy; L.E., hypermature senile cataract. Miotics were prescribed for the right eye, and cataract extraction of the left eye with guarded prognosis (because of the possibility of bilateral macular pathologic conditions) was advised. Physical examination showed moderate arteriosclerosis, blood pressure 140/75 mm. Hg, inguinal hernia, moderate benign prostatic hypertrophy, internal hemorrhoids, and an operative scar in the epigastrium.

Intracapsular combined cataract extraction was performed on November 17, 1942, under local, cocaine anesthesia, O'Brien akinesia, and retrobulbar injection of 2-percent novocaine and adrenalin. A Stallard corneo-episcleral suture was used, and the limbal corneal section with the Graefe knife included a narrow conjunctival flap above. The anterior chamber was not irrigated, and, after tying the suture, no further procedures other than binocular bandaging was necessary. Homatropine had been instilled preoperatively. The postoperative course was completely uneventful; the chamber was fully reformed and the iris pillars were in perfect position at the first dressing on the second postoperative day. The corneal suture was removed on the 10th postoperative day, when the eye appeared quiet, the media clear, and the fundus normal except for some grayish mottling of the macula, seen best with yellow light. The wound looked well healed, although biomicroscopy showed a few folds in Descemet's membrane and slight herniation of the vitreous through the pupil. Tension was: R.E., 23 mm., Hg; L.E., 7 mm. The tension varied only slightly during the remaining five months of my service, the highest tonometric reading being R.E., 26 mm. Hg, and L.E., 12 mm. in mid-December. One month postoperatively vision was: O.S., with a $+10D.$ sph. $\frown$ $+3D.$ cyl. ax. $2^\circ = 0.9$. This temporary glass without reading addition was ordered. In February, 1943, three months after operation, a mild attack of acute iritis developed with reduction of vision to 0.2. The condition completely cleared up under a regime of atropine, conjunctival packs of Pregl's solution, two intravenous injections of typhoid H antigen (10 and 20 million organisms, respectively), sulfadiazine (45 gr. daily for 4 days), and treatment of a rather severe rhinitis which was worse on the left side. The vision improved slightly, but was only 0.3 with a somewhat changed correction on March 19, 1943, when all evidence of active iritis had disappeared. There were the residua of faint pigment deposits on the anterior vitreous face and a thin ring of organized exudate around the pupil margin. Fundus examination showed the media to be clear, and in the macula were seen fine, closely packed white dots and three minute hemorrhages at the end of an inferior macular arteriole. A small pigmented patch was noted in the far upper periphery. Mercury, KI, and vitamin-B

complex were prescribed. One week later the vision had dropped to 0.1, but no central scotoma for 1/1,000 or 2/1,000 white or 5/1,000 and 10/1,000 red and green could be detected. However, blue could not be recognized. The blind spot was normal, and the peripheral field was full. It is believed, however, that had one been able to test the patient with binocular fixation on the stereocampimeter, an absolute central scotoma would have been found. Central retinal angiospasm was considered the most likely cause. According to Peter[14] early loss of blue vision indicates disease of the neuro-epithelium, while red and green changes are noted first in lesions of the conducting paths and centers.

On April 9, 1943, almost five months after operation, the phase of detachment began. However, on that day central vision had improved to 0.6 with a correction of a: +11D. sph. ⌒ +2D. cyl. ax. 45°. Objectively, the anterior chamber was almost empty, the eye was soft, and in the temporal fundus was seen a dark, smooth-surfaced hemispherical mass elevated almost to, but not obstructing, the visual axis. This was interpreted as a classical picture of choroidal detachment by the author and the consultant, Dr. K. H. Chapman. No leak could be demonstrated in the apparently well-healed operative wound. The patient was hospitalized, and bed rest and binocular bandaging were ordered. Saline cathartics, a general diet of whatever the patient wished (because of his "touchy" digestion), continuation of thiamin chloride, and instillations of atropine in the left eye and miotics in the right, constituted the rest of the treatment. Daily fundus examinations showed no change until the fourth day, when the temporal detachment had increased so that it now covered the visual axis, and a similar dark, globular, but less extensive and less elevated mass was seen in the inferior periphery, with a deep valley between it and the temporal one. No retinal hole nor any sign of serous retinal detachment was found; and the retina did not appear translucent to retro- or para-illumination with the ophthalmoscope. This method of lighting up the surrounding separated retina by throwing the narrow, bright ophthalmoscopic beam slightly off the area under study, a method described by Reese[15] to demonstrate cystic spaces in the macular retina, has been found very useful in differentiating serous and solid separation of the retina.

After 10 days of hospitalization, during which time the patient's coöperation was practically nil (he even made a clandestine trip out of the hospital), the family was consulted and the joint decision to dismiss him to his home was made. He did not return to our care after that.

The further course of the condition has been reported by Nelson,[13] whom the patient consulted two months later. At that time, the detachment was found to have extended into the nasal fundus, mild iritis had recurred, and a gray film had appeared on the upper quadrant of the posterior corneal surface and in the coloboma, which was considered to be an ingrowth of epithelium. The visual field was lost nasally, this defect being almost exactly the inverse of the detachment in the temporal fundus as we first observed it. The fundus picture continued unchanged until spontaneous reattachment occurred sometime between August 25, and October 1, 1943, that is 4½ to 5½ months after onset. An acute attack of glaucoma had supervened and subsided in July. Full recovery of central and peripheral vision eventually resulted.

This case has many interesting features:—the persistent, postoperative hypotony, inexplicable except on the as-

sumption of microscopic, but clinically undemonstrated, wound leakage or disturbed intraocular vascular balance, as evidenced by chronic simple glaucoma in the right eye, central angiospastic retinopathy in both eyes, acute glaucoma in the left eye, and generalized arteriosclerosis; the delayed onset of the detachment; its extent and size; the supervention of acute glaucoma; and the spontaneous reattachment and recovery of vision approximately five months after onset of the detachment and, even more interestingly, two or more months after subsidence of the acute glaucomatous attack.

The causation of postoperative hypotony and its role in the development of choroidal detachment, the variability of time of onset and duration, the complications, and the prognosis have been thoroughly discussed by the several authors cited above. The matter of size and location has also been considered, first by Fuchs[16] who stated that choroidal detachments are limited by the vortex veins above and below in the region of the equator so that they occur most often in the nasal and temporal quadrants.

Duke-Elder[1] says that the usual sites are the inferior, inferonasal and inferotemporal quadrants, and occurrence in the upper quadrant is rare; and the detachment may be large enough to occupy half of the fundus and reach back to the disc, and may occasionally extend around most or all of the globe.

Samuels,[17] in differentiating hemorrhagic and serous choroidal detachment, states that both blood and serum are found in greater accumulation in the region of the ciliary body, but, in extending posteriorly, blood may dissect the choroid from the sclera as far back as the optic nerve, while serum is usually confined to the normal narrower limits of the perichoroidal space.

O'Brien,[2] in his large series of postoperative cases, found that detachments appear first in the periphery and sometimes encircle it, are most often more extensive nasally and temporally than inferiorly, are sometimes flat but more usually elevated into one or more domes, but in no case do they reach backward to the macula or the nerve head. However, in one of his cases the choroidal detachment was massive enough to appear to fill the vitreous chamber. In our patient the temporal detachment was extensive enough to obscure the visual axis and a view of the macula, although it did not reach to the nerve head. Nelson[13] was of the opinion that a choroidal detachment of the extent seen in this case would be impossible without tearing the vortex veins so that devastating subchoroidal hemorrhage would result.

These various observations are in general, but only general, agreement, and they pose an intriguing anatomic problem. Specifically, how extensive and where can choroidal detachments be without damaging the vortex veins and their ampullae? The solution of the problem may be found by the application of the fundamental principles of physiologic optics and descriptive geometry,[18] a method which I have used in my investigations in intraocular localization.[19] By this method it can be shown to what extent the vortex ampullae limit the height and size of choroidal detachments in the different quadrants and zones of the eye, and an additional factor, that of location, may be brought out to aid in the differential diagnosis between choroidal detachment and serous separation of the retina.

The first step in the solution is the construction by orthographic projection on cross section paper, scale 10 to 1, of frontal, top (horizontal meridional), and profile (vertical meridional) views of a spheric anatomic eye whose dimensions

are the average measurements of normal eyes found in the literature,[19] and the schematic eye of A. Cowan.[20] Next are plotted the positions of the vortex veins and ampullae, using the external topographic data of T. Cowan[21] and the retinal coördinates for intraocular localization.[19] The average distances of the respective vorticose veins behind the limbus and their meridians of longitude measured with a protractor on Cowan's projection (fig. 1), are as follows:

mm. being attained by the superior temporal vein only. To assure ample clearance of the ampullae by the detachments the maximal diameter (0.5-2 mm.) of the ampullae has been used. Figures 2 and 3 show the average positions of the vortex veins, their ampullae, and other normal ocular structures orthographically in frontal, top, and right-side views of the right eye.

In orthographic projection, unlike perspective or pictorial presentation, the

TABLE I

AVERAGE POSITION OF THE VORTICOSE VEINS

| Exits of Vortex Veins | | | | |
|---|---|---|---|---|
| | S.N. | S.T. | I.N. | I.T. |
| Distance from limbus (LScS) | 19.3 mm. | 20.2 mm. | 18.0 mm. | 17.4 mm. |
| Corresponding perimetric sighting angle (∠Ro) | 38.8° | 36.2° | 43.8° | 46.0° |
| Meridian, measured from vertical (90°) meridian | 39.0° | 20.0° | 38.0° | 9.0° |
| **Vortex Ampullae** | | | | |
| | S.N. | S.T. | I.N. | I.T. |
| Distance from limbus (LScS) | 16.3 mm. | 17.2 mm. | 15.0 mm. | 14.4 mm. |
| Corresponding perimetric sighting angle (∠Ro) | 49.7° | 46.7° | 54.5° | 57.7° |
| Meridian, measured from vertical (90°) meridian | 39.0° | 30.0° | 36.0° | 17.0° |

The oblique intrascleral course of the vortex veins is 3 to 4 mm. in length. In Table 1, the ampullae have been placed at the average distance of 3.0 mm., anterior to the exits of the veins along the meridians of the exits of the veins, which results in an intrascleral length of vein to ampulla of somewhat more than 3 mm. but less than 4 mm., owing to the oblique course of the vein on a great circle to the meridian of the ampulla. This is in accord with the data given by Salzmann,[22] who gives the usual length of the emissaria as 3 mm., a greater length of 4.6

lines of sight are assumed to be parallel to one another as if the observer were at an infinite distance from the object; and if the direction of sight is perpendicular to the face of the object, the orthographic view shows the true shape and size of that face. A choroidal detachment protruding into the vitreous chamber may be considered to be a portion of a sphere of the same radius of curvature as the normal (undetached) choroidal sphere, and the geometric problem is, therefore, that of the intersection of two spheres which may be solved by the method of cutting

planes. The axis or central meridional plane of each of the detachments was located equidistantly between the meridians of the ampullae, and, inasmuch as these axial meridians do not coincide exactly with the horizontal or vertical meridians, the top (fig. 2) and right-side (fig. 3) views are composite showing the vortex veins and their ampullae in their true positions while the detachments are shown as they would appear in auxiliary oblique views perpendicular to the axial meridional planes (Ad). The plane of intersection of the two spheres is a straight line (a-a′, c-c′, and so forth), when viewed perpendicularly to the meridional plane, and it will be noted that these lines of intersection, where the edges or borders of the detachments meet the normal surface, have been placed so that the vorticose ampullae have been amply cleared. One may visualize these relations more easily if the frontal views be revolved about the anterior-posterior optic axis (AP) so that the detachment axes (Ad) be made to coincide with the vertical (90°) meridian in the case of superior and inferior detachments (fig. 3), and with the horizontal (180°) meridian in the case of temporal and nasal detachments (fig. 2). In this way the cross-section lines of the graph paper could be used for both views and the work reduced to two drawings. A simple model such as a hollow rubber ball indented to any desired degree up to the maximum, and viewed from different angles, will help to demonstrate these relations.

The line of intersection having been determined (for example, anterior to the ora serrata, c′, to the posterior fundus, c, in the temporal quadrant), it was easy to draw the frontal view by the method of cutting planes. The constructions show conclusively that a choroidal detachment in the temporal quadrant (fig. 2), assuming that its anterior border be in the region of the ora, d′, or in the ciliary body, c′, may be so extensive as to cover the visual axis and obscure the ophthalmoscopic view of the macula and the posterior pole, whether the determining rays pass through the posterior nodal point (N), or the pupil of exit (Px), without damage to the vortex ampullae. Similarly, a nasal detachment may appear to reach

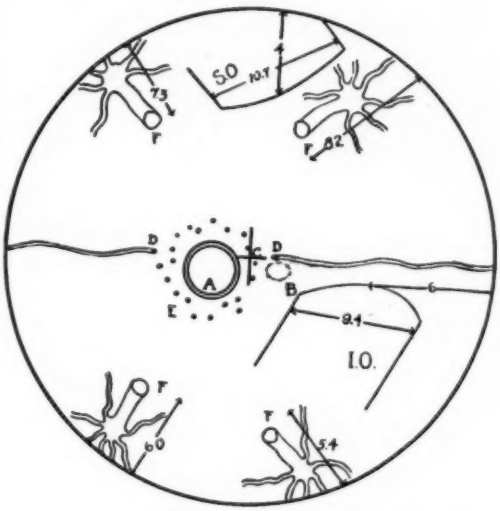


Fig. 1 (Stine). Projection of the posterior half of the globe measured on the sclera; A, optic nerve; B, macula; C, posterior pole; D, long posterior ciliary arteries; E, short posterior ciliary arteries; F, vortex vein with ampulla and tributaries. (Cowan.)

almost to the nasal margin of the optic disc. Superior and inferior detachments (fig. 3) must be smaller if their anterior borders are in the region of, or anterior to the ora serrata, but they can extend back to the nerve head or posterior limits of the suprachoroidea, if their anterior borders are situated posterior to the equator. If the detachment involves the entire expanse, a transverse fold or valley will be seen in it just behind the equator. Nevertheless, peripheral detachments in these quadrants will appear somewhat larger in the ophthalmoscopic panorama than in the orthographic view,

as they may be seen to extend back of the equator to within 45 degrees of fixation (or the posterior pole) with a meridional or transverse spread of 45 degrees or more. In any case, serous choroidal detachments are limited to the quadrants between the ampullae, or to the region anterior to them, where they may encircle the fundus; and if they are adjacent (for example, temporal and inferior), there will be a deep valley between them extending down to the normal retinal surface in the region of the ampulla.

Detachments need not be sections of a perfect sphere; their shape will depend on the shape of the globe, and rigidity or elasticity of the choroid and retina, and the effect of gravity on the subchoroidal fluid.

The surface area of the detachment, however, must obviously equal the surface area of the bed from which it is elevated. The true size and shape of detachments, choroidal or retinal, may be determined by plotting orthographically the data obtained by perimetric sighting of the edges along different meridians as pointed out previously,[18] a method which I hope to describe more fully in a later paper.

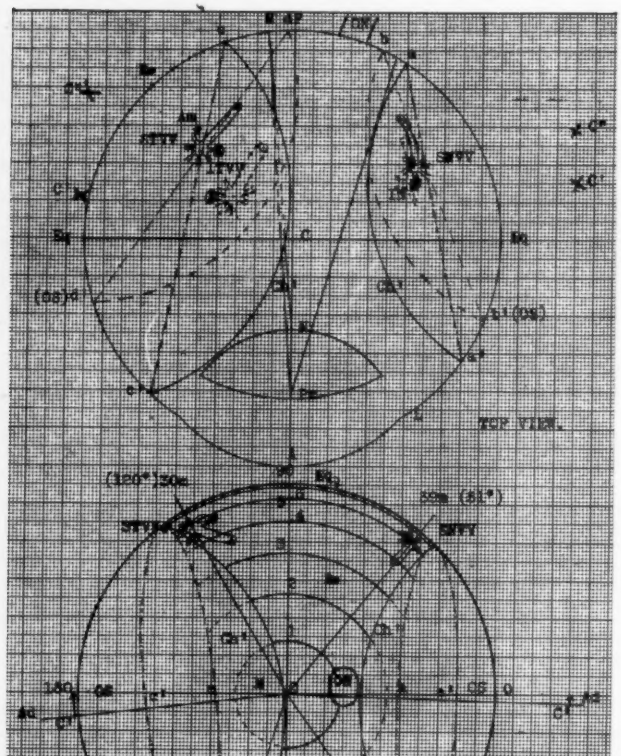


Fig. 2 (Stine). CHOROIDAL DETACHMENT. Frontal and top (equatorial and horizontal meridional) sections of schematic and average anatomic right eye, showing maximal possible extent of choroidal detachments in the temporal and nasal quadrants, scale 5:1. A, apex of cornea; P, posterior pole of globe and optic axis; M, macula; ON, optic nerve; L, limbus; Re, normal retinal or choroidal surface; Eq, equator; OS, ora serrata; STVV, ST, superior temporal vortex vein; Am, ampulla; SN, SNVV, ITVV, IT, INVV, IN, superior nasal, inferior temporal, inferior nasal veins and ampullae; Ch′, detached choroid; Ad, meridional axis of detachment; C, center of retinal or choroidal bulbar sphere; C′, C″, C‴, and so forth, centers of detachment spheres; a-a′, c-c′, planes of intersection of the two spheres (detached surface meets normal surface); ⊗, position of center of ampulla in auxiliary views to determine ample clearance of ampullae; 1, 2, 3, and so forth, latitude circles of 10°, 20°, 30° on normal retinal surface (∠Ro); 0, 90, 180, meridians of longitude radiating from anterior and posterior poles; 30m, 39m, and so forth, meridians of ampullae referred to vertical meridian; b-b′, d-d′, other possible positions of choroidal detachment; N-M, Px-P, determining visual rays, or ophthalmoscopic lines of sight in vitreous. (Note: Latitude circles anterior to equator, on or under surface of detachments are not shown. Outer scleral wall, ciliary body, and so forth are not shown.)

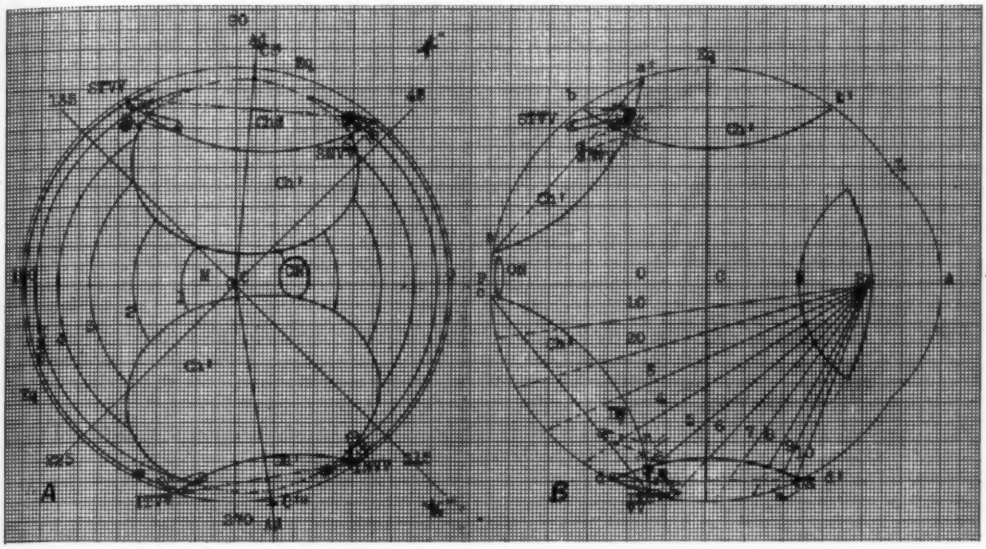

Fig. 3 (Stine). CHOROIDAL DETACHMENT. A, Frontal, and B, right side, (vertical meridional) views of right eye, scale 5:1. See Figure 2, for legend. 0-90, determining visual rays from Px in vitreous which will emerge from the eye making those angles (∠Ro) between ophthalmoscopic line of sight and optic axis.


## SUMMARY

The differential diagnosis between detachment of the choroid and serous separation of the retina is ordinarily not difficult, but may be confused by the coexistence of the two conditions, choroidal detachment being the primary lesion. However, a review of the literature indicates that retinal separation complicating choroidal detachment is extremely rare. As an aid to correct diagnosis, the sign of ophthalmoscopic retro- or para-illumination, diminished or negative in choroidal detachment and exaggerated in serous retinal separation, is described. Anatomic and topographic relations of the vorticose veins are discussed, and a method of orthographic projection to show precisely their action in localizing and limiting the size of choroidal detachments is described and illustrated. The veins being closer to the vertical meridian, choroidal detachments are larger and of higher elevation in the temporal and nasal fundus; and in the temporal quadrant, the dome of the detachment may extend to and beyond the visual axis to obscure the macula. Additional observations in a case previously reported as retinal detachment are reported to complete the record and to illustrate points in the differential diagnosis.


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# NOTES, CASES, INSTRUMENTS

## RELIEF OF EPISCLERITIS BY HISTAMINE DIPHOSPHATE

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Thinking in terms of counter irritation as a means of finding relief for the pain of episcleritis, my father and I tried histamine diphosphate instilled directly into the eye. I had previously used the drug experimentally in the eye while resident on the eye service at Bellevue Hospital, New York. The immediate relief obtained was far beyond our anticipated results. Looking back, we now believe that the relief afforded is occasioned by the lateral release of pressure on pain fibers exerted by the sharply localized episcleric node. The fairly rapid subsidence of the episcleritis after treatment with histamine may be due to the increased availability of blood produced by the generalized conjunctival flush.

The pain of episcleritis can be relieved for a period of 4 to 24 hours by the instillation of histamine diphosphate (1:1,000) in the conjunctival sac of the involved eye. The relief occurs in from 12 to 45 seconds. The episcleric node loses its tenderness and may be freely palpated. The cornea does not lose any of its sensibility as tested with cotton wool. The duration of relief has varied from 4 to as much as 36 hours. When the pain returns, it is usually mild and can be abolished again in a few seconds by the reinstillation of histamine.

This treatment has been used by my father and me since 1941. In each instance the episcleritis has subsided completely in about three days. We are unable to judge whether or not a recalcitrant episcleritis will yield to this treatment because all cases treated to date have cleared. The number of cases treated (5) is too small to speak in terms of unqualified success. At least the drug is not harmful to the eye, if properly controlled, and its use will tide the patient over a very painful episode while search is being made for the cause of the episcleritis.

Side reactions thus far encountered in the ocular use of histamine diphosphate (1:1,000) are as follows.

In one case the chemosis was enough to show in the palpebral fissure when the lids were closed. A patch and bland ointment brought a normal conjunctiva in 24 hours. Strong miosis can be produced by repeated instillations even in the presence of atropine mydriasis. In the cases tested there was no undue chemosis. In one case with posterior synechiae from an old iritis which had flared mildly, some of the more medial synechiae ruptured, but the iritis quieted nicely.

Skin sensitivity with typical histamine headache later relieved by desensitization in one case showed no unusual conjunctival chemosis. The conjunctival flush produced could be abolished in a few seconds by a drop of ephedrine sulphate (5 percent). Since thinking of ephedrine as a means of opposing the vascular blush of histamine, we have had no case with sufficient chemosis to test it.

### CASE REPORTS

*Case 1.* A white woman, 45 years of age, reported at the office with her left eye painful for the past 12 hours. Examination showed an episcleric node in the lower temporal quadrant of the eye, exquisitely tender to palpation. The remainder of the examination contributed no pertinent information. Two drops of histamine diphosphate (1:1,000) were instilled. The conjunctiva began to flush in about 12 seconds. There was a stinging sensation and the conjunctiva became

markedly flushed in about 50 seconds. The conjunctiva was slightly chemotic, the pain was entirely gone, and the node could be freely palpated without pain. The eye remained quiet for 18 hours, when it began to pain slightly. The patient returned at the end of 24 hours with moderate pain and histamine was instilled again. The same cycle of stinging and chemosis was repeated with relief of pain. The patient reported that following the first instillation the eye remained red for almost 4 hours and then gradually over another 5 or 6 hours became normal except for the episcleric node which remained congested. At the second visit the node appeared less prominent than the first day and was definitely less tender than before. After the second instillation, the eye became perfectly quiet and the patient failed to report for the general physical survey indicated.

*Case 2.* A white man, aged 64 years, reported to the office with his right eye painful for two days. Examination showed an episcleric node in the upper temporal quadrant, tender to palpation. Two drops of histamine produced a flush in about 12 seconds and relief in 40 seconds. The chemosis was very slight. Pain returned in about 24 hours, but was so mild that the patient delayed returning until the following day. Histamine again brought relief. A thorough medical examination failed to reveal any source of infection. This attack subsided after the third instillation of histamine. This patient reported back two months later with another episcleric node in the same eye and again in the temporal side. Histamine was used for two days with complete relief.

*Case 3.* A white man, 25 years of age, an infantryman in the U.S. Army, reported to the hospital with chronic tonsillitis and history of repeated sore throat. Two days after tonsillectomy the right eye developed an episcleric node on the lower temporal quadrant. Histamine instilled in the eye gave relief for almost six hours. A second dose kept the patient comfortable until the next day. Treatments on each of the two days following gave complete relief. It was felt that the infected tonsils were the source of his trouble in view of his otherwise negative physical examination.

*Case 4.* A white, 22-year-old infantryman, was wounded in action by mortar fire. One small fragment was imbedded in the episclera of the left eye, temporally, and on admission to our hospital was the center of a tender, red, raised area. The node was plainly visible in depth and contained no pus. The tenderness was characteristically that of an episcleritis. Histamine was instilled with relief in about 45 seconds. Treatment was repeated in about 8 hours. The eye was never, during this time, completely free of pain or tenderness, but so marked was the relief that the use of histamine was continued. This dose was repeated three times the following day and once on the third day. The eye was quiet on the fourth day and the small fragment was removed.

*Case 5.* A 28-year-old white man reported to my office with a painful left eye of two days' duration. There was a typical episcleric node in the lower temporal quadrant. This was very tender on palpation. Histamine, 4 drops, was instilled. There was relief in 45 seconds which lasted about seven hours. The eye became painful again but not markedly so. Another instillation kept the patient comfortable through the night. The eye was only slightly tender and painful the next morning. Histamine administered once on the second day kept the eye comfortable for 24 hours, and a final dose was then sufficient. This man was referred to an internist for a complete physical check up.

## Conclusions

Histamine diphosphate (1:1,000 solution), when instilled in an eye suffering from episcleritis, will afford immediate and prolonged relief of symptoms without the dangers of local anesthesia. In the cases so far studied it has also led to complete relief from the immediate attack. These are not enough cases to justify calling this treatment an infallible cure. The side reactions noted, miosis and chemosis, indicate the need of sensible caution in using the drug. No strong contraindications have yet been encountered in the local use of histamine diphosphate (1:1,000) in the eye.

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# A CORNEOSCLERAL SUTURE*

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Techniques of securing accurate apposition of the limbal incision by sutures, following cataract extraction, have been many and varied. Ellett's monograph† presented this subject most completely. Subsequent articles have corroborated and amplified his thesis.

One feature of the complications attendant on the removal of the crystalline lens is prolapse of the vitreous. If this hazard could be banished, or minimized, the incidence of successful results would be materially increased. It follows that a measure which effects such an end, has merit. The following plan of corneoscleral suturing has proved worthy in many cases.

An apron conjunctival flap is prepared by baring the corneoscleral junction for the upper one third of its circumference. A double-armed silk suture is placed in clear cornea at the 10:30- and again at the 1:30-o'clock positions. Corresponding bites are taken in the sclera, with each of the needles approximately 1 mm. behind the limbus. The edge of the conjunctiva is lifted, and the needles are passed from its

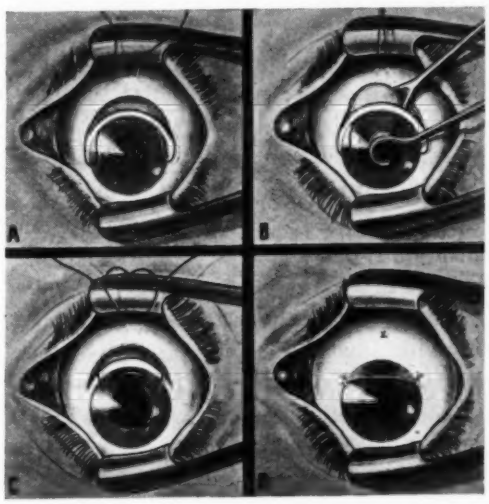

Fig. 1 (Dyar). A, the suture is looped laterally and nasally at the limbus; B, the corneal wound can be brought into apposition by a 4-point support; C, lips of the wound can be separated as desired by releasing traction above; D, the corneal suture is tied above, using a minimum of tension.

under to outer surface, 5 to 8 mm. from the free border. The suture is looped laterally and nasally at the limbus as shown in Figure 1-A, and the section is made by whatever method is desired. The remainder of the operation, up to the actual delivery of the lens, can be accomplished without interference from the sutures.

At the time when the lens presents in the wound, the ends of the suture, which are lying on the brow, are picked up by the assistant and gentle traction commenced. Any amount of aperture of the wound can thus be controlled, depending upon the wishes of the surgeon or the expediency of the moment. It is worthy of

* From the Department of Ophthalmology, Indiana University School of Medicine.

† Ellett, E. C. *Archives of Ophthalmology.* March, 1937.

note that, as the last portion of the lens is delivered, the corneal wound can be brought into apposition by a 4-point support (fig. 1-B). The lips of the wound can then be separated as desired for irrigation or repositing of the iris, by releasing traction above (fig. 1-C).

The apron flap is brought into place by fine catgut sutures, and the corneal suture is tied above, using a minimum of tension (fig. 1-D). It has been found that the elasticity of the conjunctiva aids in keeping the suture taut, until a measure of healing of the incision has taken place.

Because of the normally high surface tension of the vitreous, it is fair to assume that a large prolapse of that body cannot easily take place through an opening which has been reduced to a slit or closed. In eyes in which fluidity of the vitreous is anticipated, or known to exist, command of the width of the wound aperture is of significant value.

Sutures placed before the section is made do have the disadvantage of not effecting perfect apposition of the lips of the incision, with the exception of the McLean. It has been found, however, that a second suture can be placed at the 12-o'clock position. For this suture, the McLean principle, the Verhoeff tract, or other techniques, which insure more perfect apposition and aid in reducing postoperative astigmatism, can be employed. A bridle suture has been used in selected cases.

Removal of sutures entails little or no danger, in so far as a reopening of the anterior chamber is concerned. It has been our routine not to attempt removal for at least 10 days. As long as three weeks have elapsed before removal in numerous cases, without excessive reaction. Following anesthesia by several instillations of ½-percent pontocaine, that portion of the suture lying exposed between the two corneal bites is gently teased free with a fine foreign-body spud and is severed with scissors. The upper cul-de-sac is then exposed with a lid hook. The silk is grasped at the knot with curved dressing forceps and withdrawn through the conjunctiva from above.

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## TEAR SAC PROBED THROUGH CANALICULUS OF EVERTED UPPER LID

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*Chicago*

Passing a lacrimal probe through the upper canaliculus has certain advantages. Once the probe has been successfully introduced through the upper canaliculus, it is easier to pass it into the nasolacrimal duct, since the upper canaliculus forms a more obtuse angle with the tear sac than the lower one, which is practically at a right angle to the sac. When the tip of the probe is passed through the lower canaliculus, it not infrequently assumes a faulty position in the sac as the shaft of the instrument is brought into a vertical position. In infants and small children, the tissues of the canaliculus are so delicate that false passages and strictures of the canaliculus may result from the trauma incident to faulty technique in passing the probe. Such an occurrence is particularly unfortunate in the lower canaliculus. Since the lower canaliculi play the major part in tear conduction, strictures here result in permanent epiphora. A stricture of the upper canaliculus usually does not lead to interference with the conduction of tears into the lacrimal sac.

One reason for the comparatively infrequent use of the upper canaliculus for passage of the lacrimal probe is the awkward approach due to the position of the punctum and the canaliculus. This makes it necessary to work from below upward.

This difficulty can be easily overcome if the upper lid is everted and held in that position while the punctum and canaliculus are being dilated and while the lacrimal probe is being passed (figs. 1 and 2). Frequently, one can permit the lateral two thirds of the upper lid to fall back into its natural position during the manipulation, while keeping the medial one third everted. I have seen no reference in the literature to this technique of probing through the upper canaliculus. I have been using it on adults, as well as on children and infants, for the past three years.

Fig. 1 (Selinger). Upper punctum being dilated while lid is everted.

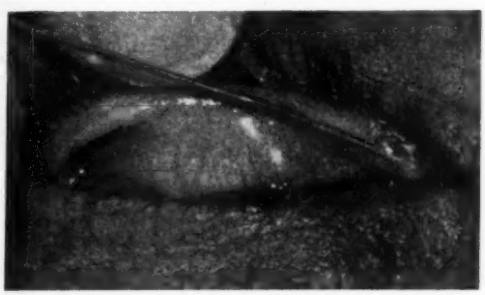

Fig. 2 (Selinger). Bowman probe in canaliculus of everted upper lid.

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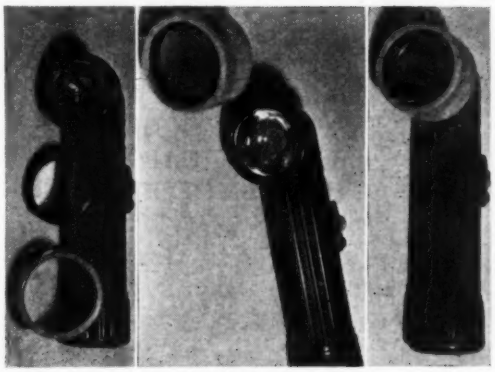
## A FOCUSING FLASHLIGHT

I. Herbert Katz, M.D.
*Syracuse, New York*

This focusing light consists of an ordinary large flashlight, a +13.00D. lens, and a holder for the lens (fig. 1).

As illustrated, the flashlight is an army type (TL 122-B), with a focusing bulb and a plano glass for protection. The bulb focuses at one foot or more and is labeled Tungsol, PR6, 2.5 volts.



Figs. 1, 2, and 3 (Katz). A focusing flashlight with the parts separated and assembled.

The lens, for sale by optical supply houses, is 40 mm. in diameter and is encased in a black plastic rim, the outside diameter of which is 47 mm. The holder is made of acrylic of a size to hold the lens snugly on the flashlight and with a small incurved rim to prevent the lens from falling out (fig. 2). This is the the only part of the apparatus that has to be made to order. The one illustrated was made by the dental department of an army hospital.

This illuminating system gives a brilliant 5-mm. spot and focuses at 65 mm., almost regardless of type of bulb. Incidentally, there is considerable variation in the brightness of different bulbs with the same batteries.

The advantages of this light in the study of the anterior segment are its brilliant spot focus, portability, long battery life, and freedom from adjustments, entangling wires, and so forth. It will be found particularly useful in clinics, at the bedside, and where large numbers of patients are to be examined. In the army, it was also useful and satisfactory for intraocular surgery.

*713 East Genesee Street.*

# SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 7, 1946

DR. BENJAMIN FRIEDMAN, *presiding*

### PROVOCATIVE TESTS IN GLAUCOMA

DR. SYLVAN BLOOMFIELD discussed this subject during the instructional hour, see this JOURNAL, page 869.

### NEW TEST FOR DARK ADAPTATION

DR. HOWARD AGATSTON stated that testing of the light sense is an important aid in diagnosis, but it has always been a laboratory rather than a clinical procedure. The test combines two techniques, namely bleaching of the retina and perimetry in dim illumination. It measures the course of dark adaptation of the central 60 degrees of retina after preëxposure to bright light.

A preliminary visual field is taken on a tangent screen, equipped with a central, red fixation light. A 2-mm. white test object is used at one meter and the extent of the field along the 45-degree, 135-degree, 225-degree, and 315-degree meridians is recorded. The eye is then exposed to the light of an X-ray shadow box for five minutes, and the visual field in dim illumination is plotted at one-minute intervals along any one or more of the meridians mentioned. The only source of illumination is a 15-watt incandescent bulb in a reflector. Its distance from the tangent screen and the angle of the beam (indirect lighting) are adjusted until a normal dark-adapted eye has a 22-degree to 30-degree field with a 2-mm. test object at one meter. This lighting is less than one foot-candle and, therefore, the eye is used as the photometer. He discussed standardization, normal curves, and interpretation of the curves.

*Discussion.* Dr. J. Mandelbaum said that the intensity of the light reflected from Dr. Agatston's test objects has not been standardized quantitatively. Judging from his description, the intensity is probably about 0.1 millilambert. At this intensity level, both the cone and the rod cells function normally. He believes that Dr. Agatston's test records the recovery of rod function as well as cone function, after exposure to bright light. It has been demonstrated by Hecht and others that dark adaptation of the cone cells proceeds much more rapidly than it does for the rod cells. The initial latent period before the test object appears at the fixation point for the normal eye represents the time required for the foveal cones to adapt to the level where the approximately 0.1-millilambert stimulus becomes visible. Only after rod adaptation is well under way does the stimulus become evident further peripherally, such as at 20 degrees.

Diminished cone function should be characterized by an increase in the initial latent period. Diminished rod function would be indicated by a recovery curve, whose slope is reduced, so that peripheral recovery takes a disproportionately long time. In order, however, to procure really precise evidence concerning the cone and rod function, more complex apparatus is required. The light-sense test, which would best suit the purposes of clinical ophthalmology, is that devised by Louise L. Sloan. It consists of a light source mounted in a box, that can be attached to the arm of a perimeter and can, therefore, be used to test any

desired retinal area. In front of the light is suspended a photometric wedge and neutral filters to cut down the light intensity. However, until instruments of this kind become available and are put in general use, tests such as devised by Dr. Agatston will be very useful.

Dr. I. Givner asked whether this method would not be of much use in diagnosing an early detachment of the retina which could not otherwise be seen.

Dr. Agatston (in closing) said that the Sloan perimeter with the illuminated test object has in the past been used to measure the light threshold of various points of the retina. The light and/or form stimulus is reduced from minute to minute. In the visual field recovery test, during the period of adaptation, the stimulus remains fixed. However, Sloan's apparatus, if available, could easily be used to make the test. In reply to Dr. Givner's question, Dr. Agatston stated that in retinal detachment a visual-field defect is usually exaggerated in dim illumination. The rate of dark adaptation of the retina near the area of the detachment would undoubtedly be prolonged. This test uncovers the area of depressed retinal function not disclosed by ophthalmoscopy or dark-room perimetry.

### Air injections in Tenon's capsule for locating foreign bodies

Dr. Benjamin Friedman stated that multiple foreign bodies in the globe, orbit and adjacent tissues cannot be localized and differentiated easily by the standard two-plane X-ray exposures. Air is injected into Tenon's capsule and stereoplates are taken with the head in a modified Water's position. The globe is outlined by a pocket of air, and its relation to the foreign body is studied in the stereoviewer. About 6 to 10 cc. of air are injected. There is an average proptosis of the globe of 2 to 3 mm., and there is an increase in the intraocular pressure of 8 to 10 mm. Hg (Schiøtz). This method is contraindicated in cases of recent perforations of the globe; extrusion of some of the ocular contents might result from the increased pressure. Bone-free dental films of the anterior globe segment may be made while the eye is proptosed.

*Discussion.* Dr. Joseph I. Pascal asked whether Dr. Friedman had had any experience with the Berman localizer. Dr. Friedman replied that he had not, since this instrument had not been made available to him in the Armed Forces.

### Abnormal retinal correspondence

Dr. E. Krimsky said that a squint may manifest normal or abnormal retinal correspondence, or the combination. Abnormal retinal correspondence is a latent suppressed tendency on the part of a squinting eye to emulate binocular fixation or projection in association with the fellow fixing eye. This is true even though the corneal light reflex be displaced from the fixational position in the deviating eye.

The displacement of the corneal light reflex from the fixational position suggests squint. Estimation of the deviation on mere inspection by the Hirschberg method is crude and inaccurate. An accurate measurement of ocular deviation is a necessary preliminary prerequisite to the study of retinal correspondence.

The artificial restoration of the displaced corneal light reflex to a fixational position is a dependable method both in the measurement of squint and in the diagnosis of retinal correspondence. Such restoration may be accompanied by the simple prism-reflex test. Additional methods include the photometric stereoscope, the synoptophore, or the anglometer.

*Discussion.* Dr. A. Linksz said that

he agreed with Dr. Krimsky's statement, that the production of identical images on so-called corresponding retinal points is not in itself retinal correspondence. Fusion in the high brain centers is an essential part of the phenomenon called normal retinal correspondence. In practice, the determination of common visual directions of the two foveas is used as an indication of normal retinal correspondence.

The double-image test of Bielschowsky, Tschermak's after-image test, the superimposition of a bird and a cage in the synoptophore are all tests for the determination of common visual direction and not of correspondence. Since the same tests are used in general for the determination of what is called abnormal retinal correspondence. Dr. Linksz emphasized the fact that these tests do not prove fusion, and thus do not prove the presence of retinal correspondence. The fact that, in certain squints, the fovea of one eye and an area other than the fovea in the squinting eye assume common visual direction cannot be denied. However, it has not been proved and Dr. Krimsky has not submitted any evidence to support the assumption that these two areas actually contribute to a fused mental image. Dr. Krimsky has, therefore, failed to prove the existence of an anomalous retinal correspondence.

Dr. Krimsky (in closing) said that the best way to determine abnormal retinal correspondence is with the aid of satisfactory artificial illumination, which enables one to observe the corneal light reflex. Such illumination can be employed with the prism-reflex test, the photometric stereoscope, the synoptophore, or the anglometer.

There are some who do not recognize the existence of fusion in abnormal retinal correspondence. If one thinks of fusion in terms of critical binocular fixation, then that would be correct. However. there are different degrees of fusion and the type found with abnormal retinal correspondence is a rudimentary macular-paramacular type associated with some relative suppression in the area of such correspondence.

Bernard Kronenberg,
*Secretary*

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## CHICAGO OPHTHALMOLOGICAL SOCIETY

May 20, 1946

PETER C. KRONFELD, *president*

CLINICAL PROGRAM

(Presented by the Staff of Children's Memorial Hospital.)

### MICROPHTHALMOS WITH CYST

DR. RICHARD C. GAMBLE presented a male infant who was first seen in May, 1945, when four months of age. The right eye was very small and turned upward. It was well formed and had no coloboma of the iris. No coloboma of the choroid could be seen, but fundus examination, even under anesthesia, was difficult. There was a purplish swelling of the temporal half of the lower lid, about 15 mm. in diameter. The left eye was normal externally but had a small coloboma of the choroid below the disc.

On June 1st, the cyst was aspirated through the skin of the lower lid and 3 cc. of thin yellow fluid were removed. The swelling disappeared at once and the eyeball came down to a normal position. The cyst was aspirated in this manner every few weeks until October 18th, at which time the eyeball and the cyst were removed. So far as could be determined there was no communication between the

interior of the eye and the cyst. Methylene blue was injected into the cyst which aided considerably in its removal, inasmuch as the wall was very thin and it was difficult to differentiate it from the other tissues. The cyst has not returned since the operation.

### Ptosis with neurofibroma of upper lid

Dr. Richard C. Gamble said that this five-year-old girl was born with the right upper lid drooping and thickened. She had café-au-lait spots on the body. X-ray studies of the optic canals were negative. She had had four applications of radium to the lid with a moderately good result. There was marked anisometropia. Vision, with correction, was: R.E., with a −8.00D. sph. ⌒ −150D. cyl. ax. 170°, 15/200; L.E., −2.00D. cyl. ax. 165°, 20/30. Discs were normal. She had worn a ptosis crutch since February, 1944, but vision was still poor in the right eye.

### Ptosis and possible neurofibromatosis of eyelid

Dr. Richard C. Gamble presented a girl, aged six years, who was first seen in January, 1945. The right eye was normal. The left upper lid had drooped since she was two years of age and was swollen and boggy. The left superior rectus muscle was paretic. A café-au-lait spot was present on the back. X-ray studies of the optic canals were negative. A ptosis operation was not advised because it was thought that the upper lid might develop more evidence of neurofibromatosis. So far this has not occurred. The condition at present is essentially as it was one year ago.

### Metallic foreign body in vitreous

Dr. Richard C. Gamble said that this 12-year-old boy sustained an injury to the left eye when he exploded a dynamite cap on August 25, 1945. He was first seen on September 10, 1945. The right eye was normal and had 20/15 vision. The left eye had 20/50 vision. There was a scar in the cornea near the limbus at the 3-o'clock position, the iris root was torn at this point, and there was a slight lens opacity. A shiny, metallic-appearing foreign body was present in the vitreous, down and temporalward. X-ray pictures showed several dozen small foreign bodies scattered through the face.

At present, vision in the left eye is 20/15. There is a slight greenish haze in the anterior lens capsule, but there is no evidence of any inflammation about the foreign body in the vitreous.

### Sympathetic ophthalmia

Dr. Richard C. Gamble said that this 39-year-old man received a severe contusion of the left eye on November 19, 1945. There was a rupture of the sclera above the cornea which was covered by conjunctiva. The anterior chamber was filled with blood. The lens was under the conjunctiva on the nasal side of the cornea. Since the lens had not absorbed, it was removed on December 4th through a small incision in the conjunctiva. Penicillin was given for a week immediately after the injury. The left eye was in relatively good condition by January 9, 1946, and very little congestion was present. Vision was: R.E., 20/15; L.E., 20/200. The right eye showed slight ciliary congestion, the pupil was small, vision was still 20/15. No precipitates were seen in the cornea. Sulfathiazole was ordered, and on January 25th the left eye was enucleated. Microscopic sections showed typical sympathetic ophthalmia.

The pupil of the right eye did not dilate well with atropine, but dilated widely with 10-percent neosynephrin, and the dilatation was maintained by atropine. Penicillin and sulfathiazole were used, but the

latter had to be discontinued because of fever and rash. At the present time the vision in the right eye is 20/15. There are a few precipitates in the cornea, the iris is mobile, the media are clear, and there is very little congestion.

### Treatment of amblyopia ex anopsia

Dr. W. Segall presented several successfully treated cases and explained the method now used at Children's Memorial Hospital in treatment of these cases. Coöperation of parents and children is essential. Amblyopia ex anopsia is not the result of an anatomic defect in visual structures, but has a physiologic etiology. The affected eye is retarded in its function but, up to a certain age, can be brought to normal or practically so. After the eighth year, the chances for improvement are usually slim, although occasionally, under proper supervision, vision in a 10-year-old child has been improved.

Routine examinations are given. These include a vision test, if possible; examination of the external eye, eye movements, the squint, the media, and the fundus; and atropine refraction and the prescribing of glasses. If the vision cannot be tested, the squinting eye should be treated as an amblyopic eye, especially if it stays in eccentric fixation and if the squint is monocular. The near-vision test seems to have some prognostic value. Improvement in near vision is noticed earlier than in distant vision. If both near and distant vision remain equally poor, the prognosis is not favorable. Covering is most important, and constant covering appears to be the most effective treatment.

While treatment in the out-patient department was only partly successful in a number of cases, attendance at sight-saving classes brought striking results in a relatively short time. This may be because proper supervision is given in the schools and is not given at home. The close work given at school, in properly illuminated classrooms and with proper teaching equipment, is especially useful. If the sight-saving classes were started at the kindergarten age, the number of successfully treated cases would undoubtedly increase.

As a rule, children tolerate the cover well if vision improves quickly. The eye is kept covered for as long a time as benefit can be noted. After the desired result is obtained, the cover is worn part time for a certain length of time. Sudden interruption in the wearing of the cover may reverse the good results achieved. The full correction given in all cases has a good effect on the squint, but the amblyopia persists. The disappearance of squint sometimes leads the parents to believe the child has been cured. If treatment is not continued, however, vision in the squinting eye usually deteriorates. Covering the good eye, with full correction in the poor eye, has been advised with the idea of treating both conditions at the same time. However, it seems most important first to correct the amblyopia by constant cover, and then to take care of the squint later. The good eye is watched carefully to guard against development of amblyopia. Children attending sight-saving classes are examined every two months, younger children much oftener.

### Scientific program

William S. Gray (by invitation) gave a paper on "The Reading Problem," and Joseph Tiffin (by invitation) spoke on "Some Visual Problems of Modern Industry."

Richard C. Gamble,
*Secretary.*

## NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

April 16, 1946

DR. HOWARD F. HILL, *presiding*

### STUDIES ON EXPERIMENTAL EXOPHTHALMOS

DR. GEORGE K. SMELSER read an interesting paper on the above subject. Dr. Smelser said that the cause of clinical hyperthyroidism and its accompanying exophthalmos had not been proved but that the anterior hypophysis was suspected, because administration of extracts of this gland to animals reproduced all of the characteristics of the disease. There is much evidence that the thyroid is not the cause of the exophthalmos; for example, in a large proportion of cases thyroidectomy does not cure but aggravates the ocular symptoms. Exophthalmos of this sort is also much more easily produced in thyroidectomized animals than in those in which the thyroid is intact. Furthermore, thyroxin administration inhibits the production of exophthalmos. The sympathetic nervous system and smooth musculature of the lid and orbit, which undoubtedly affect the width of the palpebral fissure in the hyperthyroid patient, are not responsible for the exophthalmos caused by pituitary injections. The protrusion of the eye is due to swelling of the retrobulbar tissues. Both the orbital fat and the extraocular muscles are edematous, and the edema fluid contains considerable protein. The histologic condition of these tissues is extremely similar to that seen in human cases of postthyroidectomy exophthalmos. Analysis of these tissues in experimental animals showed that in exophthalmos the lipid content of the fat tissue was unchanged and that the increase in the weight was due to water and connective tissue. The increase in muscle weight was also due to its water content, although there was some true muscle hypertrophy involved.

There are four major facts which may be involved in edema formation. Of these, the last two may be operable in exophthalmos. (1) Any increase in capillary pressure is probably offset by the increase in orbital-tissue pressure which occurs in exophthalmos. (2) There is no evidence of a decrease in the osmotic pressure of the blood (protein content) in exophthalmic animals or human beings. (3) Possibly the edema occurs because the permeability of the capillaries of the orbital fat becomes increased. Preliminary experiments with dyes and the protein content of the edema fluid suggest this possibility. (4) The drainage of interstitial fluid is poor in the orbit, for lymphatics are apparently lacking in this region. These last two factors seemed to be responsible for the edema and to be the cause of exophthalmos.

The edema may be the cause of more than just the swelling of the orbital contents for the circulation of blood in edematous tissues is impaired. This probably makes less oxygen available. The oxygen consumption of the eye muscle is very great and, furthermore, does not decrease appreciably following thyroidectomy. It seems possible, therefore, that the eye muscles in exophthalmos are handicapped by a relatively meager oxygen supply which would be reflected by their poorer function, an observable clinical fact. This weakness of the eye muscles would tend, in turn, to increase the exophthalmos secondarily.

Dr. Mahlon T. Easton,
*Reporter.*

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## THE SPRING MEETINGS, 1947

The American Ophthalmological Society held its 83rd annual meeting on June 5th, 6th, and 7th, at its favorite site, the Homestead, Hot Springs, Virginia. There were 113 members and 33 guests registered. Sir Stewart and Lady Duke-Elder from London were also present and renewed American friendships of previous years.

As usual, the program was varied; 23 papers were read and were actively discussed. It is always difficult to single out the most outstanding papers on the program of this Society, but that of Dr. Gordon M. Bruce on "Eye Changes in Pheochromocytoma of the Adrenal Gland" was ably presented and novel. Dr. A. B. Reese's paper on "The Significance of the Base Pressure in Primary Glaucoma" contained the interesting conception that the base pressure in this disease should be one of the criteria upon which should rest the decision of the type of operation re-

quired. The remainder of the program was good, and several other papers are noteworthy.

Dr. Henry C. Haden was elected president, and Dr. Bernard Samuels, vice-president. A particularly happy event of the meeting was the bestowal of the Society's highest honor, the Howe Medal, upon Dr. Lawrence T. Post, consulting editor of the JOURNAL, for distinguished service to ophthalmology. The Society voted to hold its 1948 meeting at Hot Springs, and the date will be announced later.

On Tuesday, June 10th, the Association for Research in Ophthalmology held its 16th annual meeting at Atlantic City. There was excellent attendance, and one of the best of the Association's programs was presented. Instead of the usual 10 papers, 12 papers were read, all of them of much scientific interest and value. The papers by V. Everett Kinsey on "The Transfer of Ascorbic Acid and Related Compounds Across the Blood-Aqueous Barrier" and that by Dr. Alson E. Braley on "Virus Studies in Lymphomatoid Disease of the Ocular Adnexa" were particularly worthy of attention.

A silver bowl, suitably inscribed, was presented by the Association, through Dr. Walter B. Lancaster, to Dr. Conrad Berens in appreciation of his great service in founding the Association. Dr. Phillips Thygeson is the next chairman and Dr. Brittain Payne the new trustee. Dr. James Allen was elected secretary-treasurer.

The Section on Ophthalmology, American Medical Association, joined in the centennial celebration of the parent organization in Atlantic City, in a delightful and friendly session. Sir Stewart Duke-Elder was the Foreign Guest of Honor, delivering a superb address on the "Nature of Intraocular Fluids." Dr. Frederick Verhoeff, the American Guest of Honor, gave the centennial address of the section on "American Ophthalmology During the Past 100 Years," in which he developed the historic stages of progress of our great specialty, detailing events and personages in his usual entertaining fashion. The chairman of the Section, Dr. Derrick Vail, gave as the subject of his address, "The Prestige of Ophthalmology."

Besides these special addresses, 14 scientific papers with excellent discussions were read. The quality of the program was outstanding, and each of the presentations was noteworthy. An exceptionally large number of the Fellows and members of the section were present. There were also other distinguished foreign guests present, among them Professor Arganaraz of Buenos Aires, Argentina, and Dr. Tomas Yanes of Havana, Cuba. The scientific exhibits of the Section received much favorable comment.

Sir Stewart Duke-Elder received the Research Medal of the Association for his outstanding scientific and literary researches of great value to patient and physician. That it was an exceedingly popular choice of a recipient of this great honor, was shown by the sustained and spontaneous applause by those present.

The newly elected officers of the Section are: Dr. Everett Goar, chairman; Dr. Francis H. Adler, vice-chairman; and Dr. Trygve Gundersen, secretary.

The Atlantic City meetings were saddened by the sudden death of our colleague and friend of each one of us in American Ophthalmology, Dr. Edward C. Ellett of Memphis, Tennessee, who died of coronary occlusion on his arrival at Atlantic City on June 8th. None of those who were with him in Hot Springs and heard his vigorous discussions of several of the papers there, had the slightest idea

that he would be taken from our midst so soon and so abruptly. His loss to American ophthalmology is a very great and severe blow, and we mourn grievously.

Derrick Vail.

## EYE BANKS

It is time to "Stop, Look, and Listen," to evaluate keratoplasty, and to consider the tremendous publicity that has recently surrounded the subject.

After the report of one failure of corneal transplant over 100 years ago and one success about 50 years ago, the subject lay dormant until its resurrection some 35 years later. At that time, several investigators became interested anew and, applying modern techniques, began to have some successes. Shortly thereafter this dramatic idea reached reporters who seized on it and publicized it avidly. Uncritical as most people are in fields other than their own, seeing a gold mine wherever one nugget is uncovered, corneal transplant meant to them an eye for an eye, a good one for a bad, and hope stirred in the mind of every blind man. Philanthropic individuals and organized charity were quickly aligned to be of service but the laity has almost taken over.

Firstly, what is the probable number of those who might be helped by corneal transplants? The estimates in the press varying from 10,000 to 40,000 surely paint a greatly exaggerated picture. A recent letter from one eye bank suggests that 15,000 of the 250,000 blind in this country would be benefited by keratoplasty. Can this possibly be true? Apropos of this, a careful survey of pupils in the St. Louis School for the Blind recently did not reveal a single case. A review of those on the pension rolls for the blind in Missouri has also apparently been fruitless. The operation itself is not extremely difficult. Any competent eye surgeon should be able to perform it and many eye surgeons have stood ready and waiting for suitable cases but, for the most part, the cases haven't appeared. Only a few hundred corneal transplants have been performed in the United States and already there are indications that the first crop has been harvested.

Of the operations thus far performed, perhaps somewhat because of inexperience and a desire to improve technique and to learn just what cases were amenable to betterment, many have proved futile and some definitely ill advised. Actually, we may ask what percentage of them showed significant value to the patient. The answer is not known, but from conversation with some of those most active in this kind of work, 25 percent would be a generous estimate. Frankly, therefore, we are dealing with a very restricted field, although important to the individual affected, and one that should undoubtedly be investigated but need not be overemphasized. Nothing herein written is intended to belittle or detract from the studies being made to improve techniques or the efforts to train ophthalmologists to perform keratoplasties. Both are highly desirable and their encouragement is a valuable contribution to the advancement of knowledge and the general welfare. These efforts should be continued and by no means discouraged.

Obviously, donor eyes are needed. How can they be best obtained? The idea of eye banks occurred to someone, based perhaps on the invaluable blood banks brought so keenly to the attention of the public during the recent war. Let us consider for a moment possible sources and handling of donor material. Unquestionably, present methods may and probably will be improved but, as of the moment, the best material is fresh eyes or those

after removal not more than three days previously. Then, too, the eyes obtained from cadavers must be enucleated within a few hours after death and be placed in a container at a few degrees above zero (centigrade) and shipped to the surgeon. The function of the eye bank is to interest possible donors and to store and distribute material. Actually, how do banks function? Almost every reader has heard about eye banks so that those in charge of them receive many inquiries as to how one may leave his eye for scientific purposes. Forms are sent to inquirers advising them how to act but between that and the accomplishment of their purpose lie not only the continued life of the individual but the physician attending at the time of death who must immediately enucleate the eyes, the lawyer who must be aware of the request in the will, the undertaker who is usually very unsympathetic to the idea because it makes injection more difficult, and the nearest of kin who legally controls the disposition of the body. Then, too, suitable containers for the eyes and methods of transport are difficult to obtain unless one has made advance preparation for the event, so the net result from such inquiries is close to zero. However, eye-bank organizations in a few large cities have been successful in serving as intermediaries in getting enucleated eyes for transplant purposes.

Probably the best way is to have available forms of bequest to which the attention of each patient entering the hospital is drawn in the hope that he or she will donate his or her eyes in case of death in the hospital. An ophthalmological staff that has been advised of how to act in case of death of these patients, how to enucleate, and how to block the orbits so that the injection fluid will not seep out, and that has made an arrangement in advance with the undertaker, can then occasionally obtain transplant material. By this method also more valuable eyes for pathologic examinations may be obtained. And this is a most important point because it may help solve the always difficult problem of getting eyes of deceased patients, whose cases have been interesting, for pathologic study. Indeed, a little over-publicity of corneal grafts might be excused to accomplish this good purpose.

One should applaud the efforts of organizations to obtain material for transplants, but these organizations should attempt to make the public aware of the true situation and should not indulge in gross exaggerations. The publicity has been so great and some of it so ill considered as often to hold out hope where there is no hope. By constant use of newspapers, magazines, and radio talks the procedure has been over publicized and is making the whole matter ridiculous in the eyes of the profession.

Among the latest outbursts on the subject is one by a proposed new organization addressed to some 18 well-known ophthalmologists who have been selected as surgeons capable of performing this "delicate operation of corneal transplantation." It goes on to state that "Preparations have been made for many nation-wide broadcasts to select blind patients to be operated upon as outlined in the enclosed letter being mailed to specialists in over 500 cities. The radio editors request that for this first program we shall interview on the air someone who has had his or her sight restored and then allow that person to select the next patient with all expenses guaranteed.

"To say that your coöperation is desirable is a magnificent understatement. Each of you in your own city is the very life blood of the ——— (name of organization deleted by this writer). Without you we simply cannot exist. You are the

only ones who can perform the operation. We believe our objective is one of the most noble ever attempted. If we are to survive, we must request from you the performance of two minor duties: First—Personally seek out and urge every person you know who has had their sight restored to write an interesting story about themselves to our radio editors. The surgeon's name will not be publicized. The winner will receive a wonderful trip to New York City. Second—Examine and screen out the blind in your city to obtain possible future patients for our sponsors. It is preferable that each person be examined by at least three specialists.

"Radio time has been offered to us but it must be accepted immediately. Therefore, it is most urgent that your replies be received as soon as possible. Please offer suggestions of possible additions to our list of surgeons who perform this specialized operation. Your confidence will be respected. In closing may we respectfully suggest that several thousand patients divided among the small but very exclusive group of surgeons will bring not only personal pride of achievement but considerable revenue to each surgeon as well."

The intent behind this letter may be of the best but certainly the professional advice is not such as to inspire confidence.

There is also an "open" letter accompanying the above that is much too long to quote. The financing of the surgical expense of these patients is to be solicited from 150 of America's leading advertisers.

A comprehensive symposium on keratoplasty is to be held at the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago in October and it is to be hoped that we shall learn much more about the entire subject. Let us have "The truth, the whole truth, and nothing but the truth."

Lawrence T. Post.

## THE BICENTENNIAL OF CATARACT EXTRACTION

On April 8, 1747, Jacques Daviel called to operate on M. Garion, a master wigmaker, whose cataracts appeared very favorable for surgery. Nevertheless, the expert Daviel was unable to depress either lens. At that moment he decided on a deliberate extraction. After widely opening the right cornea, he passed a small spatula through the pupil and extracted from the posterior chamber the entire lens, the capsule of which had been divided by his previous interventions. Though some vitreous was lost, the patient made an uneventful recovery, and with a cataract glass read accurately. Thus was initated the first significant advance in cataract surgery since the invention of couching by the legendary Susrutà sometime about 1000 B.C.

Accustoming himself gradually to the new operation, Daviel came to the firm decision three years later to operate for cataract only by extraction. Of a total of 240 extractions, Daviel classified 33 as failures, but the standard of success then current included all whose postoperative vision allowed walking without a guide. In his claim for priority, Daviel stressed that the idea of extraction logically followed an appreciation of the true nature of cataract, a concept which was accepted only after Brisseau's demonstration in in 1705. The lens had been previously assumed to be the seat of vision, hence the scriptural expression "precious as the apple of the eye." After Daviel's communication, his formidable operation was further popularized by Baron Wenzel who admitted destroying a hatful of eyes before achieving the requisite skill. Success demanded of the surgeon "a lady's hand, an eagle's eye, and a lion's heart."

In the century that followed the pros and cons of couching and extraction were ardently debated as each procedure was

somewhat improved. In 1772, Percival Pott, a proponent of couching, gained from his experience the conception of discission as a distinctive method of dealing with soft cataracts, and Saunders, 30 years later, demonstrated its special value in operating on children. Von Willburg, in 1785, gave couching a new lease of life by changing the maneuver from depression to reclination.

A hundred years ago, although extraction was gaining favor in Europe, reclination was still preferred in this country, being advocated by Edward Delafield, a founder of the New York Eye and Ear Infirmary, as the more successful procedure—a view strongly shared by his famous contemporary, Argyll Robertson, and many others. Some conservative surgeons attempted to avoid the evils of depression and the dangers of extraction by performing repeated discissions in most cataracts—Jacobs up to the age of 50 years, and Stevenson even included in his report a woman, aged 91 years.

At this impasse, von Graefe, whose skill and insight were universally acknowledged, pondered on improvements of technique that would make the Daviel operation less hazardous. The result was his peripheral linear section. His stimulating contributions intensified the interest in extraction, and secured its definitive acceptance even before the advent of asepsis and local anesthesia removed the dangers that von Graefe had sought to circumvent. Indeed, his innovations, except for the von Graefe knife, were finally abandoned.

From the time of Daviel the safe intracapsular removal of the cataractous lens has been the dream of the ophthalmic surgeon. The reckless technique of the Pagenstechers won few disciples, but increasing popularity came with the methods of Smith, Barraquer, and Stanculeanu. Finally the introduction of various safety measures including akinesia, superior rectus control, corneoscleral sutures, and retrobulbar anesthesia, coupled with the enthusiastic sponsorship of Knapp, Elschnig, Grosz, Sinclair, Arruga, and Manes, at long last established the intracapsular operation as the generally preferred procedure of modern cataract surgery.

Fifty years ago Herman Knapp in an analysis of a large series of cataract expressions by qualified operators found that 85 percent of the results were successful, his standard being postoperative vision of 20/200 or better. In 1,000 intracapsular extractions reported in 1944, again 85 percent were considered successful, but the standard now was a postoperative vision of 20/30 or better. In 5 percent of the cases, vision was annihilated through postoperative complications—hemorrhage, iritis, vitreous loss, corneal dystrophy, glaucoma, retinal detachment, and in one case, infection. Beneventus Grassus in his *Practica Oculorum*, the first incunabula on the eye, began and ended his operations with a prayer. In the silence of his soul what surgeon of today dare do otherwise!

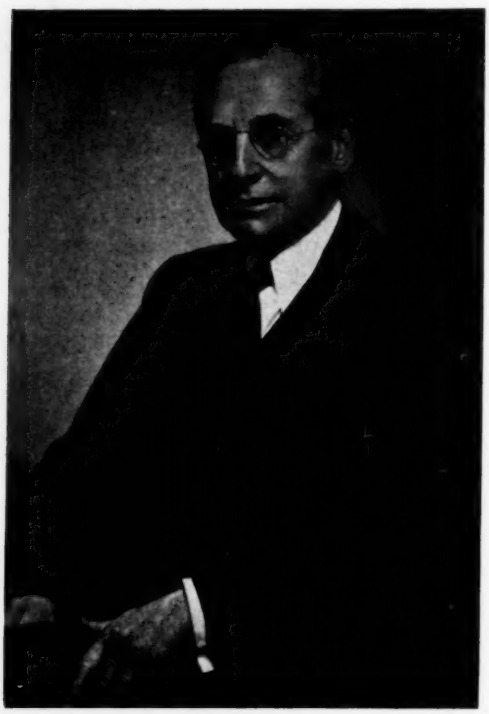
Only slowly has ophthalmology realized its measure of indebtedness to Daviel. His grave is in the cemetery of the Grand Saxonix Church, two miles north of Geneva, Switzerland, but not until 1885 was a suitable memorial placed at this shrine.

James E. Lebensohn.

# OBITUARY

## WALTER IVAN LILLIE
## (1891-1947)

When Walter Ivan Lillie died suddenly of a heart attack at his home on February 21, 1947, the medical profession lost one of its best-known and most respected ophthalmologists.



DR. WALTER IVAN LILLIE

(Photograph © Fabian Bachrach.)

Born on November 5, 1891, in Grand Haven, Michigan, Dr. Lillie was the third of four sons of Walter Irving Lillie and Ella McGrath Lillie. After his graduation from the Grand Haven High School in 1909 he entered the University of Michigan from which he received the degree of Doctor of Medicine in 1915. He interned at the University Hospital, Ann Arbor, Michigan, and from there went to the Buick Emergency Hospital, Flint, Michigan.

Walter Ivan Lillie became a fellow in ophthalmology on the Mayo Foundation on July 1, 1917, and was made assistant in ophthalmology in the Mayo Clinic. On August 11, 1917, he volunteered for military service and was assigned to active duty for a six weeks' course at the Psychopathic Hospital in Ann Arbor. On September 29, 1917, he was appointed examiner in neurology and psychiatry at Base Hospital with the 37th Division, Camp Sheridan, Montgomery, Alabama. On February 14, 1918, he was attached to the British Army in England. There he took care of shell-shocked cases in the 4th London General Hospital, British Expeditionary Forces. On April 29, 1918, he was made assistant division psychiatrist with the 41st Division, American Expeditionary Forces, St. Aigmon. He continued in the neuropsychiatric service of the American Expeditionary Forces at the First Depot Division and Base Hospital 117. Beginning February 4, 1919, he conducted examinations of command for mental and nervous diseases at Camp Meigs until he was separated from the service on March 10, 1919. After his release from the Army he resumed his fellowship on the Mayo Foundation and received the Master's Degree in Ophthalmology in 1922. He was made an instructor in ophthalmology on the staff of the Graduate Medical School in the Mayo Clinic and by 1927 had been advanced to associate professor of ophthalmology on the Mayo Foundation.

In November, 1931, Dr. Lillie traveled to Shikarpur, India, to serve with Dr. H. T. Holland at his large ophthalmic surgical clinic for a two-month period. After his return by way of the Orient in March, 1932, he continued his work at the Mayo Clinic.

Dr. Lillie was appointed professor of ophthalmology and head of the depart-

ment at Temple University School of Medicine in September, 1933. He became consulting ophthalmologist at Temple University Hospital and Shriners Hospital, Philadelphia, and at Norristown State Hospital, Norristown, Pennsylvania; and guest lecturer in neuro-ophthalmology, Graduate School, University of Pennsylvania.

On August 30, 1916, Dr. Lillie married Miss Opal C. Jones at St. Johns, Michigan, who with one son, Robert J. Lillie, survives him. Philip M. Lillie, a second son, served in the Army Air Forces and was killed on a training flight on July 31, 1944. Dr. Lillie is also survived by a granddaughter and three brothers.

Dr. Lillie was a member of the American Medical Association, the American Academy of Ophthalmology and Otolaryngology, the American Ophthalmological Society, the American College of Surgeons, the Philadelphia College of Physicians, Sydenham Medical Coterie, the Harvey Cushing Society, and Sigma Xi. He was a regular attendant at the meetings of the medical societies, both local and national, of which he was a member.

Whenever Dr. Lillie appeared on a program, he made an outstanding contribution, not only because of his unquestioned authority and ability, but also because of his direct approach and enthusiastic presentation. Although his national reputation was primarily based on his presentations of neuro-ophthalmic subjects, he was equally capable in the fields of surgical and medical ophthalmology.

In addition to contributing greatly to the success of many medical society meetings, Dr. Lillie was the author of numerous articles dealing with ophthalmology and was co-author of the textbook, *Cardio-Vascular Renal Disease*. He was also a contributing editor of the *Pennsylvania Medical Journal* and *Confinea Neurologica*.

Small-game hunting and trap shooting were his hobbies, and he was a member of the Philadelphia Country Club, the Roxborough Gun Club, and the Atlantic Indians.

Dr. Lillie always saw the brighter side of life and was so sincere and encouraging that he was able to infect others with his own contagious optimism. Even the briefest conversation with him was a tonic. His charm and ability brought him the love and respect of his patients and colleagues, alike.

Although his practice was large and demanding, Dr. Lillie never allowed it to interfere with his teaching and administrative duties. He contributed greatly to scientific literature through his own writings and to the practice of ophthalmology not only through his own participation in that specialty, but also through his active interest in training others to work in that field.

It has been said that the prerequisites for a successful physician are that he be honest, kind, and competent. Such was the way of life for Walter Ivan Lillie, and his passing has left a tremendous void in the lives of his family, friends, and medical colleagues.

P. Robb McDonald.

# CORRESPONDENCE

## GOOD, BUT NOT GOOD ENOUGH: OUR CHALLENGE

Editor,

American Journal of Ophthalmology:

The recent rapid development of interest in Industrial Vision is bringing to the office of the professional man a new type of patient. This patient is not seeking professional advice because he has become aware of a problem which he believes is associated with his vision or because he considers his vision to be faulty or below the ordinarily conceived normal. He is seeking professional advice because he is unable to compete adequately with his fellow workers on his job in those phases of effort that have to do with seeing skills.

Very frequently it is found that such patients were not originally aware, on the basis of their own observation, that their job difficulty might be due to their vision. The possible relationship between vision and industrial performance is often revealed by various fact-finding methods used by analysts working in and with industry, who have by previous controlled studies ascertained definite and varying patterns of visual skills matching job demands which make for success on the job.

These findings are further scrutinized and evaluated by professional consultants of a plant and are thus approved for use in that plant. An employee whose visual skills do not fit this pattern is directed to a professional man for investigation of his vision. He may not be personally aware that his vision is in need of attention. He has been told that in all probability his work would be better if he were able to receive visual aid.

As would be expected, visual demands in industry are sometimes more deliberately evaluated than are the symptoms which bring the usual patient to the doctor's office. Ordinarily a patient does not seek advice until his vision is obviously disturbed and he has cause for alarm. In industry, workers are being requested to seek professional assistance before their visual skills indicate serious trouble. They are being urged to visit the professional man when visual disturbances fall into a category where they can be diagnosed only in terms of an increased, although not always obviously recognizable, difficulty in performing the industrial task.

It is, therefore, to be expected that among these industrial patients the proportion of individuals with severe visual defects is much lower than among a random group of ordinary patients. The visual demands of industry are intricate and sometimes the worker whose visual skills fall well within the normal by the usual clinical criteria may nonetheless experience difficulty in performing his job. Where we would normally hesitate to ask a patient to change his lenses if he read 20/20, O.U. for near, so that he could read 20/15, we now need to realize that a job pattern may indeed demand 20/15 and then we must prescribe the change. The same may be true of a symptomless exophoria which nevertheless is found by statistical methods to be improper for a certain job and therefore should receive orthoptic training. Some learn, reluctantly perhaps, that a man can be handicapped in the performance of his job because he may require better than normal eyes.

One job which the authors recently observed in a printing establishment involved the preparation of lithographic plates. These workers were comparing photographic negative plates with original copy for shading of colors and silhouetting. Exact shades of color are obtained by varying the concentration of the dots which in the finished plate will transfer

the color to the page. These dots are so small as to be barely discernible with the naked eye but the worker must obtain the proper concentration (to insure the proper shade) and the proper distribution (to insure proper silhouetting of the picture detail). The worker on such a job must seek "better than normal" eyes. His near visual skills are of greatest importance. By statistical analysis it was found that the best workers on this job showed near-vision acuity equivalent to 20/15 or better, at 13 inches—not at the usual 20/20.

Therefore, workers whose near visual acuity was the equivalent of 20/20 were being referred to professional men for further visual aid (if possible), since their job required at least an equivalent of 20/15. Here the professional man must adjust his usual clinical concept of when to correct acuity further and must prescribe for the best possible acuity. He must recognize the need of some highly specialized workers for extremes of perfection in visual functions.

Similar critical qualities of vision are found necessary for such jobs as hosiery looper, gager of fine parts, assembler of small mechanisms (such as cameras and watches), to name but a few. Among 450 industrial jobs studied by the Occupational Research Center, Purdue University, 10 percent were found to require distant-vision acuity in both eyes better than 20/20; 20 percent were found to require better than 20/25. Among the same group of jobs, 13 percent were found to require acuity better than 20/20 at 13 inches, and 33 percent, or one third, better than 20/25.

These figures illustrate the number of jobs where visual demands are such that workers with normal or near-normal vision may, nevertheless, actually be handicapped to a degree in performing their specific industrial tasks. Furthermore, the standards used by industry are usually *minimum* standards and represent only the vision needed to keep up on the industrial job. For more success and more outstanding performance, even higher visual acuities may often be desirable.

It becomes apparent, therefore, that the professional man treating industrial patients must add to his present task of correcting visual defects—a brand new concept of effort, that of improving visual *skills* which may include one or more factors (especially acuity and muscle balance). The clinical methods of improving these skills are already in use but our attention must be focused more sharply on them. New testing methods and new correcting procedures are being developed to meet the increasing challenge of this task. Our present equipment, especially for near-point problems, is inadequate.

No longer is the professional man responsible only for giving assistance where some obvious clinical impairment is recognized, but he must now seek to provide additional assistance where job demands require raising the workers' visual skills above the category "good" to the one of "best."

Hedwig S. Kuhn,
Hammond, Indiana.

Newell C. Kephart,
Purdue University,
Lafayette, Indiana.

# ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

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## 1

### GENERAL METHODS OF DIAGNOSIS

Contino, Filippo. **A new method of determining pupillary diameter.** Rassegna Ital. d'Ottal., 1946, v. 15, Nov.-Dec., pp. 450-460.

The author has constructed an apparatus composed of a telescope and a Lobeck measuring ocular. The chinrest of the biomicroscope table is used and the measuring device is attached to the movable arm of the same. (2 figures.) Eugene M. Blake.

Hughes, W. L. **A combination red filter and occluder.** Amer. Jour. Ophth., 1947, v. 30, May, p. 609.

Owens, W. C. **A fixation light for the cardinal directions of gaze.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 611-613. (9 references.)

## 2

### THERAPEUTICS AND OPERATIONS

Bakker, A. **The action of sulphanilamide on rabbits' lenses in vitro.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 216-219.

Sulphanilamide, not above the therapeutic level, is quite harmless for explanted lenses of rabbits. When the concentration is elevated, it is noted that the lenses from very young rabbits become opaque; however the toxicity of sulphanilamide for lenses from adult rabbits is less pronounced.

O. H. Ellis.

Cavazzini, Mario. **The activity of penicillin in the presence of pupillomimetic drugs.** Rassegna Ital. d'Ottal., 1946, v. 15, Nov.-Dec., pp. 518-529.

The extreme lability of penicillin and the fact that such drugs as atropine, pilocarpine, and adrenalin are frequently employed locally at the same time as the penicillin, induced the author to study the effects of such drugs upon therapy with penicillin. The latter is a monobasic acid (pH about 2.8). The miotics, mydriatics, and local anesthetics were introduced into solutions of penicillin in vitro and did not

affect the potency of the antibiotic; nor did the latter exert a baneful effect upon the action of the drugs. No incompatabilities were discovered. (2 figures.) Eugene M. Blake

Cortes, Herman. **Results of sulphonamide therapy in ophthalmology.** Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, July, pp. 664-672.

A detailed study of each patient that was successfully treated with sulphonamide is reported. The lesions were acute and purulent conjunctivitis, corneal ulcers with hypopyon, and metastatic endophthalmitis. The drug used was Albucid (sulfacetamide) and was administered locally and systemically.
J. Wesley McKinney.

Costi, C., and Alvarez Maribona, T. **Use of crystalline penicillin in ophthalmology.** Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, July, pp. 644-663.

The authors report the good results obtained by the local use of crystalline penicillin in acute, subacute, and chronic conjunctivitis, tracoma, acute, subacute, and chronic dacryocistitis, corneal ulcers, and corneal ulcers with dacryocistitis. The detailed study of each patient is described briefly.
J. Wesley McKinney.

Dubois-Poulsen, A. **Retrobulbar ciliary neurotomy.** Ann. d'Ocul., 1946, v. 179, Nov., pp. 578-590.

As a substitute for enucleation in painful blind eyes, especially in glaucoma, opticociliary resection was abandoned because of severe complications including orbital hematoma and exophthalmos. Destruction of the ciliary ganglion involves a complicated technique and trophic corneal disturbances are not infrequent. Section of the ciliary nerves between the ganglion and the eyeball is preferable. After canthotomy the conjunctiva is dissected from the limbus above and below and the external rectus is temporarily resected. Arruga's speculum for retinal detachment is introduced and the long ciliary nerves are fixed between two strabismus hooks and cut. The external rectus is replaced and the canthotomy and conjunctiva are sutured with silk. The operation is followed by few complications. The tension after a brief drop may rise to its previous level, but the corneal edema is permanently relieved. Seven illustrative cases which are presented include primary glaucomas and glaucomas following hypertensive retinopathy and venous thrombosis. (27 references.) Chas. A. Bahn.

Duguid, J. P., Ginsberg, M., Fraser, I. C., Macaskill, J., Michaelson, I. C., and Robson, J. M. **Experimental observations on the intravitreous use of penicillin and other drugs.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 193-210.

The authors present results of experiments on the intravitreal injection of penicillin and other drugs. Commercial penicillin, sodium sulphacetamide, marfanil and V. 335(p-methyl sulphonyl benzylamine) introduced into the vitreous were damaging to the retina to a degree which excluded their use clinically. Sodium sulphacetamide and pure penicillin either together or separately in the vitreous were found to diffuse rapidly into all parts of the eye, and the vitreous acted as a depot for replenishing the drug lost from the other tissues. It was found that pure sodium penicillin was highly effective in the control of infections of the vitreous body, and that chemo-therapeutic levels could be maintained by intravitreal injections of 2000 units every two days. Pure sodium penicillin caused minimal

retinal destruction, and its use seems indicated and justifiable in certain cases of infection. O. H. Ellis.

Garcia Miranda, A. **Penicillin in ophthalmology.** Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, July, pp. 617-643.

The author has made a complete review of the literature on the tolerance of the various ocular tissues for penicillin and the concentration of penicillin in these tissues after various methods of administration. It was found that penicillin reaches the highest concentration in the tissues when it is given locally. Good results were obtained by means of this drug in the treatment of blepharitis, conjunctivitis, keratitis, infection of the uveal tract and some other intraocular septic processes.

J. Wesley McKinney.

Kornerup, Tore. **Investigation in variable monochromatic light of the outer vessels of the eye.** Acta Ophth., 1946, v. 24, pt. 4, p. 423.

Nine cases of inflammation are reported, in which areas of pericorneal injection were examined in variable monochromatic light. The shifting of the diffusion spectrum at various stages of the inflammation that produced the pericorneal congestion is illustrated with graphs, and is attributed by the author to the marked difference of the diffusion spectrum from arteries and veins. The changes in the diffusion spectrum were different in periods of clinically demonstrable improvement and of persistent inflammatory process. In several cases a change in the diffusion spectrum indicative of improvement preceded the clinical symptoms. Ray K. Daily.

Matteucci, Pellegrino. **The effect of retrobulbar injection of alcohol upon ocular tissues.** Rassegna Ital. d'Ottal., 1942, v. 11, Nov.-Dec., p. 483.

Following the retrobulbar injection of alcohol there may result exophthalmos, chemosis, hypoesthesia of the cornea, mydriasis and pupillary torpidity, corneal alterations, variations of tension and vasodilatation of the vessels of the orbit, uvea and retina. The optic nerve does not present appreciable histologic alterations. Injection of over 70 percent solutions of alcohol should be given guardedly where vision is good or any corneal change exists. The treatment is limited to patients with absolute or hemorrhagic glaucoma, where severe pain is present. The reduction of tension in glaucoma is not sufficient to warrant the injection in acute or chronic simple glaucoma. Vasodilatation sometimes follows and weak concentrations of alcohol may be employed in iridocyclitis with hypertension. In experimental animals the vasodilitation was evident in microscopic sections of the optic nerve, retina and orbit. (4 figures.)

Eugene M. Blake.

Rosengren, Bengt. **On the depth of cauterization in surface diathermy, with special reference to amotio operations.** Acta Ophth., 1946, v. 24, pt. 4, pp. 389-416.

Investigations in which cattle liver was used as test material showed that the depth of cauterization is influenced by several factors. It is increased if the water content of the surface is high. It is greater if diathermic coagulation is performed with a weak current acting for a longer time, than with a strong current acting for a shorter time. It increases with the size of the electrode. If the degree of moisture in the surface, and the time of coagulation are standardized, it is possible to regulate the

depth effect quite accurately by using different sizes of electrodes. The author found that an even and adequate penetration is obtained when he uses a ball electrode 1.25 or 1.00 mm. in diameter on a slightly damp scleral surface, and when pergamentization appears in 2 to 3 seconds. (5 illustrations.)

Ray K. Daily.

Vannas, Mauna. **On the use of rib cartilage grafts for correction of cosmetic defects caused by enucleation.** Acta Ophth., 1946, v. 24, pt. 3, pp. 225-237.

After a brief review of the literature on the various type of implants used after enucleation, Vannas reports the technic of implantation of rib cartilage that is covered by perichondrium. On the basis of 36 operations, he regards this as the most satisfactory implant material. The implant is covered with a pouch that is made with the help of catgut suture, over which the four rectus muscles are tied with catgut. The conjunctiva is closed with silk. The perichondrium is expected to prevent absorbtion of the cartilage. To correct retraction of the upper lid Vannas uses implantation of perichondrium, with almost no cartilage. From the free end of the patient's lower rib a piece of cartilage 3 cm. in length is excised; it is split longitudinally, and almost all the cartilage is removed; the two thin plates of perichondrium are placed against each other, surface outwards. A vertical incision 1 to 1½ cm. in length is made lateral and superior to the external canthus, and a shorter incision is made nasally. With curved scissors an arch shaped space as high as possible under the supercilium, and under the fibers of the orbicularis is prepared, and the implant is pulled into it by a clamp introduced through the nasal incision. Since retraction of the upper eyelid is unpredictable, Vannas suggests that at the time of enucleation a piece of cartilage be excised, and buried subcutaneously in the chest wound, to be easily available if required later.

Louis Daily, Jr.

Wofflin, E. **A new procedure for extraction of intraocular nonmagnetic foreign bodies.** Ann. d'Ocul., 1946, v. 179, Nov., pp. 591-593.

Some amalgams have the power of adhering firmly to metals on contact. In the author's experiments with this ingenious idea, he used copper, silver, and sodium amalgams on very fine rods to remove zinc, copper, and aluminum foreign bodies imbedded in gelatin that had the consistency of human vitreous. Animals' eyes were also used in these experiments. The amalgam of sodium solidified faster but was possibly irritating to the human eye, although not to the eyes of guinea pigs. Five minutes or more of contact was necessary for a suitable catalytic adhesion. The amalgam must solidfy at the normal temperature of the human vitreous. The author desires to interest other ophthalmologists in the experimental development of the ophthalmic use of amalgams, especially in the removal of intraocular nonmagnetic foreign bodies.

Chas. A. Bahn.

## 3

## PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bárány, Ernst. **A theory of binocular visual acuity, and an analysis of the variability of visual acuity.** Acta Ophth., 1946, v. 24, pt. 1, pp. 62-92.

The literature is reviewed, and the causes of the variability of instantaneous visual acuity discussed. The method used in this investigation is

described in detail; it consisted essentially of instantaneous exposure of Landolt rings, with a rotating apparatus, under a standard illumination, and with an apparatus which was equipped with automatic regulation of the exposure time. The average instantaneous acuity variability in about 30 eyes was found to be ± 20 to 25 percent of the visual acuity value. A new explanation is advanced for the higher visual acuity even in emmetropic subjects when both eyes are used. It is based on the assumption that the instantaneous acuity fluctuations are due mainly to causes individual for each eye, and that consequently when both eyes are used one eye can see well at the instant when the other eye sees badly. No central cooperation beyond this random intercomplementing is assumed. The mathematical calculations of these assumptions agree with the experimental results, and indicate that the cerebral factor is not significant.

Ray K. Daily.

Eames, T. H. **A study of tubular and spiral central fields in hysteria.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 610-611. (9 references.)

Koch, Walter. **An improved dark-adaptometer.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 235-237.

A redesigned and improved dark-adaptometer is presented. Filters of different colors can be brought into position as well as neutral filters for altering the intensity of light. The instrument allows for a wide range of readings on patients with gross disturbances of dark adaptation.

O. H. Ellis.

Mandelbaum, J., and Sloan, L. L. **Peripheral visual acuity: with special reference to scotopic illumination.** Amer. Jour. Ophth., 1946, v. 30, May, pp. 581-588. (1 table, 2 figures, 7 references.)

Martin, L. C., and Pearse, R. W. B. **The comparative visual acuity and ease of reading in white and colored light.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 129-144.

These experiments were performed to determine differences in visual acuity and in ease of reading in white and in red light. A view box was designed in which all factors remained constant including the intensity of the white or red light. The test object was a slide on which was printed a grating with 55 lines to the inch. The general levels of illumination used were approximately 0.06, 0.6, 6.0 foot candles. The tests were binocular and the observers varied in age from 14 to 50 years. The results are recorded in detail in tabular form. They indicated that among the lower levels of illumination, red light was as much as 80 percent more efficacious than white and at the higher levels there was little practical difference.

In studying the ease of reading the observers were made to read separate, plainly printed words in varying intensities of white and red light and the numbers of words read were recorded. There was little practical difference, although white was probably better in higher levels and red better in lower levels. A third and purely subjective test of simply having the observers read for 30 minutes by the two lights and describe differences in ease and comfort revealed again no appreciable differences.

Morris Kaplan.

Stomberg, A. E. **The psychology of the squinter.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 601-606. (6 references.)

## 4

### OCULAR MOVEMENTS

Carelli, P. V. **Relation of the near point of convergence to squint surgery.** Illinois Med. J., 1947, v. 91, March, pp. 124-126.

Primary divergence insufficiency should be treated by surgery on the external rectus muscles. Accommodative convergence excess should have a trial period of glasses and atropine, whereas a moderate recession of the stronger internal rectus is indicated when there is no accommodative factor. Irwin E. Gaynon.

Cojazzi, Luigi. **Acoustic phenomena provoked by ocular movements.** Riv. Oto-Neuro-Oft., 1943, v. 3, May-June, pp. 165-174.

A 25-year-old man developed signs of arachnoiditis of the posterior cranial fossa after a radical operation performed for otitis media of his left ear. Gaze to his left was accompanied by a noise of constant pitch inside the left ear which disappeared when the eyes returned to the primary position. The author discusses the explanations offered in the literature for this rare phenomenon and assumes that in his case an irritation of the vertebral sympathetic vasomotor system was responsible for the noises. (Bibliography.) K. W. Ascher.

Levit, L., and Giqueaux, R. **Supranuclear ophthalmoplegia.** Anales Argentinos de Oft., 1946, v. 7, July-Aug.-Sept., pp. 75-78.

A twelve-year-old child is presented with a history of encephalitis at the age of eight months. At the present time there is a total peripheral facial paralysis, more marked on the right side, a right lingual hemiatrophy, and loss of all conjugate eye movements. The lesion is believed to be supranuclear and probably in the posterior longitudinal fasciculus. Edward Saskin.

Malbran, Jorge. **Etiopathogenesis and therapeutics of strabismus.** Arch. Chilenos de Oft., 1946, v. 2, March-April, pp. 95-104.

This well-written article of ten pages deals especially with the problem of amblyopia in relation to prognosis from treatment, and with the surgery of the condition. W. H. Crisp.

Suarez Villafranca, Manrique. **Surgery in strabismus.** Arch de la Soc. Oft. Hisp.-Amer., 1946, v. 6, July, pp. 676-686.

In the surgical treatment of strabismus the author performs partial tenotomy of the inferior two-thirds of the antagonic muscle and spreads the untouched fibers. With this technique he obtained good results in 75 percent of patients. The other 25 percent (deviations over 7mm.) showed slight hypocorrection of one and a half millimeters. In these patients tenotomy of the muscular fibers untouched in the first operation was done. Of 47 patients, 41 had convergent squint and 6 divergent. This method failed in only three. (11 illustrations.) J. Wesley McKinney.

## 5

### CONJUNCTIVA

Colombo, G. L., see Luiggi, Gan, this section. Prof. Colombo of Milan has informed us that the Ann. d'Ocul. inadvertently credited his article to Gan Luiggi (Colombo), instead of Gian Luigi Colombo.

Luiggi, Gan. **Rickettsia in nummular epidemic conjunctivitis.** Ann. d'Ocul., 1946, v. 179, Nov., pp. 594-596.

It is probable that conjunctival Rickettsial diseases vary greatly in their pathologic and clinical patterns. In a patient with acute epidemic conjunctivitis the bacterial findings were negative, but Rickettsial bodies were present. The technique included alcohol-ether fixation for 5 hours, Giemsa staining for 24 hours and subsequent rinsing. The Rickettsial bodies observed were smaller and less regular than those in trachoma. (3 references.)

Chas. A. Bahn.

Murray, J. O. **Stevens-Johnson syndrome, report of two cases.** Lancet, 1947, v. 1, March 15, pp. 328.

The author reported two cases of Stevens-Johnson syndrome, one with only mild conjunctivitis, and the second with profuse purulent conjunctival discharge, but without corneal inflammation. Both patients ran a comparatively mild course and cleared completely. This was interesting, as the author points out, because in many of the previously reported cases serious ocular complications have occurred, including blindness. O. H. Ellis.

Nellen, Maurice. **Stevens-Johnson syndrome.** Lancet, 1947, v. 1, March 15, pp. 326-327.

A case of Stevens-Johnson syndrome with severe constitutional symptoms and eruptions affecting the skin and mucosa is reported. Accompaning the purulent conjunctivitis, granular swellings were present in the upper quadrants of the bulbar conjunctiva. These were possibly the remains of subsiding vesicles, but cleared without complications. Patients with similar findings have been reported elsewhere as "erythemia exudativum multiforme pluriorificialis," and under other headings.

O. H. Ellis.

Thygeson, P. **Clinical signs of diagnostic importance in conjunctivitis.** Jour. Amer. Med. Assoc., 1947, v. 133, Feb. 15, pp. 437-441.

There are a number of clinical signs, both gross and biomicroscopic, which are of diagnostic importance in conjunctivitis.

Changes in the regional lymph nodes, the lid margins, the limbus and cornea are of almost equal diagnostic importance with those occurring in the conjunctiva itself. By clinical examination alone it is possible to identify many of the various etiologic types of conjunctivitis. When these clinical observations are correlated with cytologic and bacteriologic studies, the cause can be determined in a high percentage of cases.

Theodore M. Shapira.

Willcox, R. R., Findlay, G. M., and Henderson-Bebb, A. **Treatment of Reiter's syndrome by gold salts.** Brit. M. J., 1947, April 12, pp. 483-484.

Certain strains of pleuropneumonia-like organisms give rise to arthritis and conjunctivitis in rats and mice. Pleuropneumonia-like organisms are sensitive to gold salts. Two patients with Reiter's syndrome were cured by the use of gold salts (Myocrisin,) whereas adequate dosage of typhoid, penicillin, and sulfthiazole therapy failed to be of any value. Irwin E. Gaynon.

## 6

### CORNEA AND SCLERA

Almeida Rebouças, José de. **Corneal ulcer from varicella.** Rev. Brasileira de Oft., 1946, v. 5, Dec., pp. 105-114.

The author records five cases of corneal ulcer from varicella, in which the clinical course differed from that ordinarily described for cases in other parts of the world. Previous case

records have mentioned mild photophobia, mild pericorneal injection, rapid cicatrization, ready healing under ordinary therapy, and a delicate final scar interfering little with visual acuity. The author's patients had intense photophobia, intense pericorneal injection, cicatrization requiring from two to four months, resistance to all therapeutic measures, and a subsequent dense leucoma with considerable reduction of visual acuity. W. H. Crisp.

Casari, G. F. **Acute pemphigoid of the cornea.** Rassegna Ital., d'Ottal., 1946, v. 15. Nov.-Dec., pp. 511-517.

The case described occurred in an 11-year-old girl, ill with polyarticular rheumatism and endocarditis. Small hemorrhagic spots appeared first upon the face and then became general. Even the palms of the hands showed vesicles filled with serohemorrhagic fluid and the oral mucosa was affected. On the twenty-eighth day the left cornea became completely opaque and soon a large central ulcer with purulent secretion developed. There was no glandular enlargement. Smears and culture showed extracellular cocci in clusters, with 2 percent of eosinophiles. Healing eventually took place but vision was reduced to light perception. The term pemphigoid is applied to this condition to correspond to the more recent classification of bullous cutaneous eruptions. Eugene M. Blake.

Figueiredo, N. P. de. **Opacification of the cornea from obstetric traumatism.** Rev. Brasileira de Oft., 1946, v. 5, Dec., pp. 115-119.

After forceps delivery, in addition to local swelling and hemorrhages, the left cornea was completely opaque. The condition rapidly improved, and after 61 days all that remained of the disturbance were some striae. The condition has been attributed to rupture of Descemet's membrane, with secondary swelling. W. H. Crisp.

Nectoux, R. **Keratitis in epidemic parotitis.** Ann. d'Ocul., 1946, v. 179, Nov., pp. 597-600.

Among the rarer complications of mumps is keratitis. Less than ten cases have apparently been reported in the world literature. During an attack of epidemic parotitis a 47-year-old woman had a transient corneal edema in one eye with slight ciliary injection that lasted about one month. There were numerous folds of Descemet's membrane, the cornea was temporarily hypesthetic and numerous erosions existed on the anterior surface. Complete healing occurred within 30 days. (5 references.) Chas. A. Bahn.

Pickrell, K. L. **Tattooing of corneal scars with insoluble pigments.** Plastic and Reconstructive Surg., 1947, v. 2, Jan., pp. 44-59.

Knapp first introduced this technique in 1925. Pischel, in 1930, spoke of its failure and only one article has been written on the subject since then.

The effect of 2-percent and 5-percent preparations of iron, gold, silver, and platinum on the intact and the de-epithelized cornea of rabbits was noted. Corneal scars were first produced in albino rabbits by instilling 10-percent solution of formalin into their eyes. The scars were first tattooed with a single pigment. There was no change even after several months. Injections of colors for detailed shades were next made seven to ten days after the first or basic color injection. The final desired color could not be obtained by mixing the necessary pigments and using this mixture at one time.

Three cases of tattooing in man are presented; the patients were white females aged 7, 18, and 20 years respectively. Three tattooings about two weeks apart were performed in the child; the others received four, at five to six day intervals. Slight discomfort from photophobia was the main complaint following the treatments. After 12 to 18 months there has been no fading or dispersion of pigment. In these cases vision seemed improved by a reduction in the photophobia when light from troublesome intraocular beams were absorbed in the cornea.

Francis M. Crage.

Pinticart de W., E. **Tuberculosis, tuberculoses, tuberculous toxemias, and tuberculin therapy.** Rev. Brasileira de Oft., 1947, v. 5, March, pp. 159-166.

These subjects are very briefly considered by the author, whose paper is mainly devoted to the report of a personal case. A woman of 29 years, who had three living children and had lost one from an intestinal affection, was again in an early stage of pregnancy. An ocular inflammation was attributed to a blow on the eyebrow two weeks previously. The inflammation, which was a keratitis, and which had been noted on the hospital record at the eighth month of a previous pregnancy, appeared to have become aggravated by the present pregnancy. Ocular pain became less after artificial interruption of the pregnancy, but a month later a small tubercle of the iris was found although the eye was no longer congested. Sterilization was recommended.

W. H. Crisp.

Volero, M. **Neuroparalytic keratitis and heterochromia in syringomyelia.** Rassegna Ital. d'Ottal., 1942, v. 11, Nov.-Dec., p. 435.

Volero describes a case of neuroparalytic keratitis and heterochromia in a patient with the bulbar type of syringomyelia. He concludes that the trophic changes which develop in the cornea are not due, as is commonly held, to a lack of trophic impulses, nor to the presence of abnormal irritative stimuli, but to the loss of the normal control exercised by antidromic impulses resulting from faulty cellular exchange. The keratitis is due directly to the syringomyelia and not to the loss of lacrymal secretion.

Eugene M. Blake.

Zondek, B., Landau, J., and Bromberg, Y. M. **Allergy to endogenous hormones as a cause of keratitis rosacea.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 145-155.

Zondek has previously shown that the occurrence of typical allergic symptoms as a result of hypersensitivity to endogenous hormones is not uncommon. In this report six cases of rather severe keratitis rosacea that resulted from proved sensitivity to testosterone are reported. All patients had been refractory to the usual methods of treatment. They were treated by desensitization to testosterone by a course of subcutaneous injections supplemented by implantations of 10 mg. of the hormone under the skin. Improvement was appreciable.

Morris Kaplan.

## 7

## UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bárány, E. H. **The influence of intraocular pressure on the rate of drainage of aqueous humour. Stabilization of intraocular pressure or of aqueous flow.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 160-176.

These experiments were performed to investigate the existence of a mechanism for regulating intraocular tension by slowing or speeding the rate of aqueous flow. Such a mechanism is assumed to exist. All previous experiments have actually been unphysiological in that in all some trauma was inflicted upon the eye. Bárány maintained a completely normal physiologic relationship and arrived at contrary conclusions. The changes in tension were accomplished by pressure on the unilateral common carotid artery. The rate of aqueous flow was determined by the use of a radio-active sodium isotope as a tracer substance. It was shown that the sodium concentration remained approximately the same in the two eyes though only one underwent pressure changes as great as 20 percent.

Morris Kaplan.

Cyukrasz, Ida. **A case of bilateral genuine iris-atrophy.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 176-179.

A 24-year-old woman complained of blindness in one eye and poor vision in the other. The tension in each eye was 56 mm. Hg. In each eye the iris consisted mostly of atrophic strands of varying width, some of which adhered to the lens. Cornea, lens, vitreous and retina were normal and both discs showed deep glaucomatous cupping. No evidence of previous inflammation could be found and the diagnosis of genuine iris-atrophy was made. It probably arose as a regression in the pupillary evolution in the fourth month of prenatal life. Cyclodialysis in the right eye was followed by normal tension.

Morris Kaplan.

Francois, J. **Heterochromia iridis of Fuchs.** Ann. d'Ocul., 1946, v. 179, Nov., pp. 559-576.

Six cases of heterochromia iridis are presented to illustrate the different stages and types of this condition. Diminishing density of the iris stroma with subsequent atrophy and pigment absorption and dispersion especially in the posterior portion constitute the principal pathologic feature. Associated are noninflammatory corneal precipitates, posterior cortical lens opacities and imbalance of the sympathetic nervous system, usually of the paretic type. Among the rarer complications are glaucoma, retinal detachment, and vitreous degeneration. The symptoms usually begin about the age of 20 years. Usually there is ciliary injection and synechias are completely absent. The principal explanatory theories postulate inflammation, sympathetic nervous system degeneration, and dysraphic degeneration. No single theory apparently explains all cases. Fuch's heterochromia iridis is apparently a degenerative genetic syndrome, involving defective structure of the iris and lens with partial or complete lack of normal tissue repair. Another part of the syndrome is a degeneration of the autonomic nervous system especially involving the cervical sympathetic portion.

Chas. A. Bahn.

Hartmann, E., and Braun-Vallon, S. **Ocular toxoplasmosis.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 524-530.

Bilateral disseminated chorioretinitis involving the perimacular region suggests toxoplasmosis, particularly in infants. The parasite is 4 to 6 μ by 2 to 3 μ pear shaped, easily inoculated into guinea pigs and mice, and is frequently found in rodents and birds. The exact mechanism of infection, especially of infants, is not known.

In infants the infective process is essentially an encephalomyelitis which

is frequently fatal. Mothers usually have antibodies in their blood but are free from symptoms. In older children and adolescents the process is less acute with fewer constitutional symptoms. In adults the liver and spleen are frequently involved in the general infection, which is usually less severe than in the young and which clinically resembles Rickettsia infections, especially typhus fever. The basic lesion is a small perivascular granuloma in which lymphocytes, epithelioid cells and occasionally eosinophiles are present. The infection reaches the primarily involved choriocapillaris and the first neurone of the retina through the blood stream. The chrioretinal lesions may be confused with those of hereditary lues, small pox, measles, tuberculosis, lead poisoning, and congenital coloboma. The location of the ocular lesions, the absence of marked proliferative changes, and the bilateral occurrence are characteristic. The extraocular symptoms, positive complement-fixation test in the acute stage, positive rabbit and mouse inoculation, and calcium deposits in the cerebellum further facilitate differential diagnosis. (18 references.) Chas. A. Bahn.

Jona, S., and Bauce, A. **Considerations on an atypical case of Harada's Disease.** Riv. Oto-Neuro-Oft., 1946, v. 21, May-Aug., pp. 168-182.

A woman, 43 years of age was suddenly taken sick with violent headache and high fever. After a few days, there was loss of vision of the right eye. Ophthalmoscopic examination revealed a red reflex from the fundus and a retinal detachment below. Her spine was rigid, and the spinal fluid contained lymphocytes. There was also a reddish maculo-papular eruption on the skin and vesicular lesions of the lips and mouth. The general symptoms abated in a short time but seclusion of the pupil persisted. The herpetic lesions of the mouth suggest that the disease was caused by a herpetic virus which was uveotropic. (Bibliography.)

Melchiore Lombardo.

Laval, Joseph. **Hemmorrhage in sarcoma of the choroid.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 607-609. (4 figures.)

Martin-Jones, J. D., **Uveal Sarcomata.** Brit. Jour. Ophth., 1946, Monograph Supplement 11.

This monograph brings our knowledge and the literature of this large subject up to date. Two hundred and sixty-three cases were completely investigated. Heredity was a possible factor in only two instances, and although trauma was often mentioned, it was a very questionable causative agent. Previous choroidal hemorrhages and old pigmentary changes in the fundus were, in some cases, thought to be predisposing factors. The condition appeared equally in the two sexes and at any age. The average age was in the sixth decade. Most of the eyes were nearly blind at first examination; however five had 6/6 vision.

The average duration of symptoms was 19 months, and differential diagnosis was rarely difficult when the fundus was clearly seen. In no case was a hole or tear of the retina seen with sarcoma of the choroid, and detachments with increased intraocular pressure (present in 50 percent of cases) were usually neoplastic in origin. The glaucoma may have been caused by the formation of a plasmoid type of fluid, as well as the usual mechanical blockage.

The choroidal type is the most com-

mon intraocular sarcoma and most frequently arises in the posterior pole. Bilateral or multiple choroidal sarcomas are extremely rare. The spindle celled growths are the most common, those composed of epithelioid cells alone are rare, and the mixed cell type is the most malignant.

The author presents a comprehensive discussion of the origin of these tumors, and conclusively shows them to be mesoblastic in origin.

More than one half of the patients died within ten years after operation. The patient who survives for ten years is probably cured. Malignant cells in the emissaria are not necessarily of bad prognostic import but extraocular involvement is. There was no evidence to show that intracranial extension of the growth occurred when the optic nerve was invaded by sarcoma cells. Reticulum staining on a group of specimens confirmed the work of Callender and Wilder as to the prognostic importance of the content of the reticulin fibers in the tumor.

Extraocular extension of the growth is the exception and not the rule, and early enucleation is the treatment of choice. Exenteration of the orbit does not increase the chance of survival and radium or X-rays probably are as effective.

Sarcoma of the iris is rare. It arises from proliferation of the stroma cells, usually on the lower half of the iris and also should be removed early by enucleation. (20 illustrations and photomicrographs.) O. H. Ellis.

Matteucci, Pellegrino. **Sympathetic innervation of the uvea and its neurovegetative regulation.** Rassegna Ital. d'Ottal., 1946, v. 15, Nov.-Dec., pp. 484-498.

Mawas demonstrated a neurovegetative regulatory system in the retina and along the course of its vessels. This system consists of ganglion cells and microganglia of a sympathetic nature. This is contrary to the usual opinion that the retinal arteries are not under direct influence of vasomotor nerves. Matteucci conducted experiments upon rabbits and disagrees with Mawas and Magitot. His experiments seemed to show that the autonomic regulation of the uveal vessels is a sinus reflex, which regulates the intracranial and general arterial pressure and appears to act in a direct manner through the medullary bulb upon the caliber of the uveal vessels and the ocular tension. The sympathetico-adrenal and parasympathetico-colinergic systems are represented only by way of transmission of these reflexes.

The vacillations of general arterial pressure do not seem to act in a mechanical sense upon the caliber of the uveal vessels. Considerable difference of opinion exists among physiologists, anatomists, and others working upon the problem of the nervous control and uveal vessels, general and vascular arterial pressure and in intraocular tension, and knowledge in this field is in a state of flux. (2 figures.)

Eugene M. Blake.

Pinticart de W., E. **Tuberculosis, tuberculoses, tuberculous toxemias, and tuberculin therapy.** Rev. Brasileira de Oft., 1947, v. 5, March, pp. 159-166. (See Section 6, Cornea and sclera.)

Roper-Hall, M. J. **Research in Zurich.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 223-228.

The author presents a summary of the work done at Zurich on the pathological changes in the aqueous humor and the blood-aqueous barrier. Over

1900 anterior chamber punctures were done on normal and diseased eyes. The cells, which are increased in inflammation, originate in the blood and neighboring tissues. The predominant role of the reticuloendothelial system in a great number of cases of chronic uveitis was noted. Albumin was increased in proportion to the number of cells, and in chronic inflammations there was a dissociation found between the albumins and the cells, comparable to that observed in the pathologic cerebrospinal fluid. Cultures were rarely positive even with strongly positive smears, and tubercle bacilli were found in only one case. Organisms found in the anterior chamber in keratitis and anterior uveitis were of etiologic significance.

The permeability of the blood-aqueous wall was studied with the intravenous flourescein method. Trauma, uveitis, and most general diseases show an increased permeability; however the findings in glaucoma varied. It was found that the flourescein test showed more minute changes in the permeability of the wall than the Tyndall effect. O. H. Ellis.

Rubino, A., and Rosselli del Turco, L. **A case of uveitis with vitiligo; study of Vogt-Koyanagi's disease.** Riv. di Oftalm., 1946, v. 1, Sept.-Oct., pp. 553-571.

A 15-year-old girl had been suffering from bilateral iridocyclitis since the age of 9 years. At the age of 8, she had a tracheobronchial adenopathy accompanied by loss of weight and one year later pulmonitis was diagnosed. Two years after the eyes became involved, the skin showed patches of depigmentation. The anterior part of the uvea was only slightly involved; the vitreous of both eyes contained diffuse opacities consisting of powderlike pigment particles. The disease recurred at irregular intervals, and reduced the visual acuity of the right eye to 3/50, and of the left to 3/10. The authors concluded that the disease was a transition between Vogt-Koyanagi's and Harada's disease. A virus, similar to, or identical with, herpes virus, could produce the vitiligo by invading the terminal branches of the cutaneous nerves and also might produce the ocular lesions. It could likewise be assumed that an allergy of the skin was associated with a hyperergy of the eyes or that pigment-dissolving antibodies might have been formed in the uvea. (1 photograph, references.) K. W. Ascher.

Valero, M. **Neuroparalytic keratitis and heterochromia in syringomyelia.** Rassegna Ital. d'Ottal., 1942, v. 11, Nov.-Dec., p. 435. (See Section 6, Cornea and sclera.)

## 8

## GLAUCOMA AND OCULAR TENSION

Bárány, E. **The influence of local arterial pressure on aqueous humor and intraocular pressure. An experimental study of the mechanisms maintaining intraocular pressure.** Acta Ophth., 1946, v. 24, pt. 4, pp. 337-387.

This is a detailed report of a comprehensive investigation on rabbits, in an effort to demonstrate the presence of hemostatic reflexes which control the intraocular pressure. The tension of the eyes of rabbits with a van Leersum carotid loop was measured with a tonometer under local anesthesia, from a few seconds to three hours after clamping the loop. The difference in the pressure of the two ophthalmic arteries caused by the unilateral carotid occlusion was estimated from the difference in the peripheral pressure between the

two halves of the head; this was determined by compression of the two central arteries of the ear of the moderately heated unanesthetized animal. That a direct correlation exists between the two pressures was shown by a direct determination of the pressures in the ophthalmic arteries. The absolute difference between the ophthalmic artery pressures is greater than the difference between the ear artery pressures, but the ratios are approximately equal. The graphic data show that on closure of the carotid the mean blood pressure in the ear artery drops to one third of the starting level, but recovers rapidly during the following few minutes, and after 10 minutes keeps a constant level of about one half of the pressure on the other side. This level is maintained for at least one hour. At the same time the intraocular pressure gradually drops by about 4 mm. Hg during the first two seconds, and about ½ mm. during each subsequent second. During the following few minutes there is a partial recovery. On the average the intraocular pressure drops about 3.5 mm. Hg within three minutes after the carotid is closed. There is no sudden change of the curve to indicate the existence of a reflex that quickly regulates intraocular pressure. On the contrary, the extent and the rate of recovery of the intraocular pressure closely corresponds to the recovery of blood pressure. During the hours following carotid closure the intraocular pressure remains at a constant level of about 3 to 3.5 mm. Hg below that of the control eye. There is no indication of a regulating reflex of slow action.

Ray K. Daily.

Bozzoli, Alessandro. **Perforating diathermy coagulation of the corneoscleral limbus in ocular hypertension.** Riv. di Oftalm., 1946, v. 1, Sept.-Oct., pp. 631-633.

This preliminary note reports a new procedure used in ten cases of ocular hypertension. After retrobulbar anesthesia, a small conjunctival pocket is undermined beginning 1½ cm. above the limbus. Every bleeding vessel is electrically coagulated to avoid hemorrhage. The electric needle is used to penetrate the limbus in the same direction as one would enter with a keratome to perform a paracentesis. As soon as the needle enters the chamber (amperage not indicated) aqueous humor will escape and a few bubbles will form in the chamber. A peripheral iridectomy can be performed with the needle or can be added separately. The postoperative course was uncomplicated and the intraocular pressure remained normal for many months. The advantages of the operation are its simplicity, cleanliness, and absence of hemorrhage. No lens opacities were observed.

K. W. Ascher.

Cristini, Giuseppe. **Clinical considerations on the action and effects of X-ray therapy on spinal sympathetic centers and superior cervical ganglion of normal and glaucomatous eye.** Riv. Oto-Neuro-Oft., 1946, v. 21, May-Aug., pp. 199-225.

The author tested the effect of Roentgen irradiation of the spinal cord and the superior cervical ganglion in 15 patients some of whom had normal eyes others latent or well developed glaucoma. Eleven of the patients were men and four women and they ranged in age from 32 to 73 years. The results are given in tabular form. In glaucoma the sympathetic vegetative regulation is depressed. The writer emphasizes the importance of this new therapeutic procedure to reduce the increased intra-

ocular tension temporarily. (Bibliography.) Melchiore Lombardo.

Louhela, T., and Teräskeli, H. **On the results of different glaucoma operations.** Acta Ophth., 1946, v. 24, pt. 1, pp. 27-43.

A brief review of the Scandinavian literature on antiglaucomatous operations is given, and an analysis of the results of 520 operations on 474 eyes is made. This is the material of the Helsinki Hospital for the years 1930 to 1942. The data are tabulated. In acute glaucoma iridectomy is the procedure of choice. A comparison between the results of cyclodialysis and iridencleisis takes into account the effectiveness of the procedure, and the complications incident to it. Of the two procedures cyclodialysis has proved more effective in reducing tension. The most feared complication of antiglaucomatous operations, which is cataract, does not occur immediately in cyclodialysis. It occurred once in 206 cases and was the result of faulty technic. In iridencleisis this complication does occur. If the time of observation is sufficiently long, however, cataract is encountered with about equal frequency after both operations. Impairment of the visual function, in the absence of cataract, is more frequent following cyclodialysis, and the end results are therefore slightly better after iridencleisis. It is difficult to determine to what extent these degenerative changes are due to the disease itself, and to what extent to surgery. The authors suggest that perhaps the sensitive uvea is subjected to more damage in cyclodialysis than in iridencleisis. (6 tables.) Ray K. Daily.

Sjögren, Henrik. **A study of pseudoglaucoma.** Acta Ophth., 1946, v. 24, pt. 3, 239-294.

This term is applied by Thiel to glaucoma without increased ocular tension. A comprehensive review of the literature, and brief reports of nine cases of glaucoma without hypertension show that every conceivable combination with and transition to glaucoma have been described. Glaucoma without hypertension can pass over into hypertension and vice versa. Glaucoma can be present without hypertension in one eye, and with it in the other; in unilateral glaucoma the tension may be heigher than in the normal eye without exceeding the normal limits or may be equal and normal in both eyes, or may even be lower in the diseased eye. In unilateral glaucoma the tension may rise in both eyes, and in bilateral glaucoma the tension may rise in one eye only; occasional rises of tension may occur in pseudoglaucoma. Acute inflammatory phenomena may develop without increase in tension, or with a slight rise that does not exceed the physiologic limits. Eyes with normal tension may exhibit occasional rises during the day, or in response to provocation. The disease may be familial, or one member of the family may have glaucoma with hypertension, and another without. After surgery, glaucoma can progress as glaucoma without tension. The pathologic changes and the functional disturbances are the same in glaucoma with and without hypertension. The pathologic picture is similar to that in cerebral atrophy; glaucoma and the brain changes may occur simultaneously in the same person. The depth of the excavation of the optic nerve has no relation to the height of the pressure and it is frequently deeper in glaucoma without tension; a high tension may exist a long time without the occurrence of excavation of the

disk. It is suggested that glaucoma with and without hypertension are the same disease, and that the term pseudoglaucoma be reserved for congenital anomalies or pressure atrophies simulating glaucomatous excavation. The author agrees with those who hold that the basis of glaucoma is a circulatory disturbance independent of intraocular pressure. The disturbance of vascular function may produce glaucoma with hypertension, glaucoma without hypertension, and cerebral atrophy. If the disturbance involves the anterior part of the eye the result is an anterior glaucoma with hypertension; if it is located in the posterior portion of the eyeball the clinical manifestation is posterior glaucoma without hypertension; if it is located in the brain it leads to cerebral atrophy. The reported cases show that these processes may occur singly or in combination. (33 visual fields and tension curves.) Ray K. Daily.

Weekers, L., and Weekers, R. **A new contribution to nonperforating cyclodiathermy in the various forms of glaucoma.** Acta Ophth., 1946, v. 24, pt. 1, pp. 1-24.

In this exhaustive presentation the authors review the history of the application of cyclodiathermy for glaucoma, and the technic is described. Application of the electrode over the conjunctiva results in conjunctival burns somewhat larger than the electrode, at the bottom of which one sees the apparently uninjured sclera. A detailed analysis of 76 cases of various types of glaucoma thus treated shows the effect of the procedure on the eye. Histologic sections of enucleated eyes shows that the dominating process after cyclodiathermy is an enormous vasodilatation in the uvea, followed by exudation. Four months later an eye showed a slow cicatricial process with atrophic areas in the ciliary body. Cyclodiathermy is believed to result in a change in the equilibrium between the production and resorbtion of fluid, in the eye, in favor of greater resorbtion. The hypotonizing effect of cyclodiathermy is constant and pronounced. The operation is indicated in chronic glaucoma in which other operations have failed, and it is the operation of choice in absolute glaucoma. It is effective in the various types of secondary glaucoma. In acute glaucoma its hypotensive effect is marked but transitory.

Ray K. Daily.

Zaretskaya, P. B. **The effect of electric stimulation on ocular tension.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 489-590. (2 figures, 2 references.)

Zondek, H., and Wolfsohn, G. **Primary glaucoma and the pituitary-diencephalic system.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 596-600. (10 references.)

## 9

## CRYSTALLINE LENS

Arruga, H. **Mishaps and complications in the cataract operation.** Ophth. Ibero Amer., 1946, v. 7, no. 4, pp. 275-280.

The author deals with the various difficulties under the following headings: blepharospasm, small cornea, shallow anterior chamber, friable conjunctiva, emptying of the anterior chamber, hemorrhage into the anterior chamber, ocular hypertension, vitreous in the anterior chamber, anterior synechia, posterior synechia, intumescent cataract, resistant zonula, rupture of the zonula, escape of vitreous, expulsive hemorrhage. W. H. Crisp.

Di Ferdinando, R. **Etiologic relationship between juvenile cataract and war conditions.** Riv. di Oftalm., 1946, v. 1, Sept.-Oct., pp. 617-630.

The eyes of six soldiers with bilateral lens opacities are described. Three had posterior subcapsular opacities, three had punctate opacities of the coronary type. Psychic trauma, vitamin deficiency, and neuro-humoro-hormonal imbalance may have been the cause of the opacities. (4 figures, bibliography.) K. W. Ascher.

Huggert, A. **The thickness of the cortex of the crystalline lens in different ages.** Acta Ophth., 1946, v. 24, pt. 1, pp. 43-62.

The article includes a comprehensive review of the literature, and a report of original investigations on 303 experimental subjects in an attempt to measure the absolute axial thickness of the cortex of the lens at different ages. The method of using Lindstedt's apparatus with slit-lamp illumination, and the subsequent calculations are described in detail. The distances measured were from the surface of the cornea to the anterior surface of the lens; to the anterior surface of the adult nucleus; to the posterior lens pole; and to the posterior surface of the adult nucleus. The data are reported graphically. The thickness of the anterior lens cortex is relatively similar at all ages, and increases by about 0.007 mm. per annum; the calculated thickness of the posterior cortex is probably the same. The size of the adult nucleus appears to be unchanged throughout the years.

Ray K. Daily.

Huggert, A. **Are the discontinuity zones of the crystalline lens iso-indicial surfaces?** Acta Ophth., 1946, v. 24, pt. 4, pp. 417-421.

With a refractometer Huggert examined samples of lens substance that had been removed under slit-lamp observation from various areas of a zone of optical discontinuity. The results indicate that the zones of discontinuity are iso-indicial surfaces.

Ray K. Daily.

## 10

### RETINA AND VITREOUS

Alvaro, M. E. **Use of roentgen rays in treatment of retinal disorders characterized by new formation of vessels—Eales disease, arteritis, periphlebitis and endophlebitis, proliferating retinitis.** Rev. Brasileira de Oft., 1946, v. 5, Dec., pp. 71-87.

The author discusses at some length the probable effect of X rays upon the capillary circulation, as studied by various writers on radiology. The hematopoietic organs are extremely sensitive to X rays. Moderate doses cause immediate dilatation of the capillaries. The action of the rays may also include a greater permeability of the endothelium. Conflicting results stated by different authors arise from wide variation in the dosage employed, but there is more or less unanimity in the opinion that the dosage should be very small, always less than one skin erythema dose, and in most cases not more than one half of this dose, generally administered in fractions. According to Alvaro, the hard rays should be employed. Clinical experience over several decades appears to justify the employment of X rays in the treatment of the conditions mentioned in the title. (Bibliography.) W. H. Crisp.

Arruda, Jonas de, and Sebas, S. R. **Degenerative macular disorders.** Rev. Brasileira de Oft., 1947, v. 5, March, pp. 135-155.

A study of the literature leads the author to suggest that these lesions be classified into two main groups, acquired and hereditary, with six subdivisions: (1) acquired; central recurring retinosis, exudative macular retinosis, and cystoid degeneration of the macula; (2) hereditary; hereditary degeneration of the macula, colloid hereditary degeneration of the macula, and macular degeneration in familial amaurotic idiocy. (5 illustrations reproduced from other authors; short bibliography.)

W. H. Crisp.

Drualt, A., and Drualt, S. **Anterior limits of the retina.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 531-539.

The anterior attachment of the retina is not concentric with the corneal limbus, but slightly more forward on the nasal side, which facilitates the larger temporal visual field. Nasally the retina extends to within 8 mm. of the corneal limbus and temporally to about 10 or 12 mm. Retinal function extends forward to approximately the level of the ocular nodal point which corresponds with the center of the lens. This is of importance in the surgery of retinal detachment. In section, the retina is approximately two thirds of a circle, and is attached firmly only at the ora serrata and the optic nerve. Peripherally the proportion of rods to cones is approximately 20 to 1. (17 references.)

Chas. A. Bahn.

Falls, H. F. **Inheritance of retinoblastoma, two families supplying evidence.** Jour. Amer. Med. Assoc., 1947, v. 133, Jan. 18, pp. 171-174.

Two pedigrees are presented to support the contention that retinoblastoma is a hereditary form of neoplasia. In one family bilateral retinoblastoma occurred in each of a pair of "single cord" female identical twins, the third such pair in the literature. The tumors were noted at the age of six months, and both infants quickly died. In the other family the mother of a child with retinoblastoma had an enucleation of her left eye at the age of 3½ years because of retinoblastoma. Five of the nine siblings of the mother's generation had diagnoses of retinoblastoma, and two of these survived to reach childbearing age. This pedigree adds to the list of reported observations of the "vertical transmission" of the neoplasm. The author strongly feels that parents of a child who develops retinoblastoma should have no more children, and that any survivor of enucleation for retinoblastoma should be sterilized. (2 figures, abstract of discussion.)

Bennett W. Muir.

Gordon, D. M. **The treatment of retinitis pigmentosa with special reference to the Filatov method.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 565-579. (1 table, 39 references.)

Gördüren, Süreyya. **A Grönblad-Strandberg syndrome.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 228-232.

The author discusses the literature and presents an interesting case of Grönblad-Strandberg syndrome, with the two components of the disease, angioid streaks and pseudo-xanthoma elasticum, clearly demonstrated. Angioid streaks, which are due to the widespread degeneration of elastic tissue were present in both eyes. A large yellow raised mass was present in the posterior pole of one eye. The skin of the neck and abdomen had a parchment-like appearance with raised yellow streaks. Microscopic examination of the skin in biopsy, showed degeneration of the elastic elements. (7 illustrations.)

O. H. Ellis.

Holm, Stig. **Macular proliferation (pseudotumor) and closely related pictures of disease (retinitis circinata, Coats's disease, etc.)** Acta Ophth., 1941, Supplement 18.

The cases of macular proliferation and borderline cases, and the reported cases of retinitis circinata that have been examined histologically are reviewed. A clinical, ophthalmologic, and histologic description is given of a case of macular proliferation in the form of a pseudotumor, which presented the picture of retinitis circinata, in a woman 82 years of age. The pseudotumor was twice as large as the largest pseudotumor that has been reported. A case of a subretinal hemorrhage with macular proliferation is also reported. An analysis of this material suggests that an activation of the pigment epithelium layer of the retina is the primary cause of the development of pseudotumor. This activation may have induced the intense proliferation of pigment cells. It seems probable that the pigmented epithelium is responsible for the new formation of connective tissue. The ganglion cell layer was found intact, which accounts for the absence of changes in the optic disc. The histologic basis of retinitis circinata is not definite; the ophthalmoscopic picture of retinitis circinata may be caused by intraretinal changes, by subretinal accumulation of fluid, and by newly formed subretinal connective tissue and subretinal degenerated pigment epithelium. The review of the literature shows that ophthalmoscopically and histologically the picture of macular proliferation may also be seen in angiomatosis of the retina, in the macular changes in angioid streaks, in exudative macular juvenile retinitis, and in chronic central retinochoroiditis. The soft membranes of the eye seem to react in the same manner to different pathologic agents. The differential diagnosis from a malignant tumor is very difficult, and transillumination does not give definite data. (12 photomicrographs, 6 fundus photographs.)

Ray K. Daily.

Kaminskaya-Pavlova, Z. **Pathogenesis of fundus changes in skull injuries.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 613-615.

Longhena, Louisa. **Gangliectomy for treatment of retinosis pigmentosa.** Riv. Oto-Neuro-Oft., 1943, v. 3, May-June, pp. 135-153.

Resection of the stellate ganglion of the sympathetic was performed in seven patients suffering from retinosis pigmentosa. In one the operation was performed bilaterally. In three patients, no improvement of the visual function was observed and in one, a slight improvement occurred; In three other patients, the visual acuity was increased distinctly after the operation, and in two of them the visual fields were less constricted after the operation. Dark adaptation also was improved in some of the patients. Early operation is advocated to preserve what is left from the slowly degenerating retinal tissue. After the operation, ptosis and miosis become obvious and persist for an indefinite period; conjunctival hyperemia is always present; the retinal vessels are dilated for months in some patients, but in others the vascular diameter does not seem to be markedly greater in the eye of the operated side. Moderate headaches, pain in the neck and in the shoulder were observed occasionally; in two patients, a permanent hoarseness followed the operation.

K. W. Ascher.

Schneider, R. W., McCullagh, E. P., Ruedemann, A. D., Kennedy, R. J., and Lewis, L. A. **Hemorrhagic diabetis retinitis; a method of treatment based on the elevation of plasma albumin by diet.** Cleveland Clin. Quart., 1947, v. 14, April, pp. 76-80.

In patients with diabetic retinitis, plasma proteins are normal or slightly reduced in quantity and there is a relative decrease of albumin and increase of beta globulin. Plasma albumin levels in this group are not readily corrected, and 100 to 200 grams of protein per day for many months are necessary to decrease the tendency to exudation and hemorrhage. Of 16 patients observed for two to three and a half years the plasma protein pattern was corrected and the recurrent hemorrhages disappeared in six, and were decreased in one. Irwin E. Gaynon.

Paez Allende, F. **A case of arachnodactyly, or Marfan's disease, with subluxation of both lenses and high myopia.** Anales Argentinos de Oft., 1946, v. 7, July-Aug.-Sept., pp. 81-85.

This typical syndrome consists of elongated stature, long extremities with fine, elongated, spidery fingers and toes, muscular hypotony, easy dislocation of body joints, luxation or subluxation of the lenses, myopia, and various other secondary derangements, physical and mental. The etiology and pathogenesis cover the fields of toxic states, muscular dystrophy, atavisms, primary hormonal disease, and disturbances of the nervous system. In the presentation of the author's case, a seven-year-old girl, the following features were of diagnostic importance: height greater than normal for her age, asthenia, melancholy facies, long, tapering fingers, left partial heterochromia iridis, bilateral iridodonesis, bilateral nasal subluxation of the lenses, and over twenty diopters of myopia. (Bibliography.)

Edward Saskin.

Weinstein, P., and Forgács, J. **Circulatory studies of the fundus of the eye.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 238-242.

Patients with spontaneous venous pulsation of the blood vessels of the fundus have a better retinal circulation and have 50 percent less retinal complications than persons without pulsation. In patients with pulsation the pressure drop from the arterial to the venous circulation is greater; without pulsation the arterial pressure is established at a higher level which signifies capillary obstruction. Spontaneous venous pulsation disappears with the reduction of intraocular tension by massage of the globe. O. H. Ellis.

## 13

### EYEBALL AND ORBIT

Azzolini, Umberto. **Orbital angioma.** Riv. Oto-Neuro-Oft., 1943, v. 3, May-June, pp. 184-198.

A 42-year-old woman had suffered from headaches for years, and noticed protrusion of her left eyeball and increasing diplopia for the past two years. An unreducible proptosis was found and the external rectus muscle of the left eye was paretic. Radiologically an opaque region was found in the left orbit, and a Kroenlein operation was performed, with the tentative diagnosis of meningioma. A cavernous angioma was found. The postoperative course was complicated by a hemorrhage into the tip of the orbit, which slowly was reabsorbed. (7 figures.)

K. W. Ascher.

Babel, J. **Orbital chronic inflammation and pseudo-tumors.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 540-550.

Many years ago Birch-Hirschfeld divided slow space-taking orbital lesions with slight or no inflammatory reaction into three groups: 1. those which disappeared after nonspecific therapy; 2. those which contain diffuse chronic inflammatory tissue; 3. those characterized by the formation of lymphoid and degenerative vascular changes.

A 62-year-old woman had a slight recurrent inflammation of the lids and orbit with exophthalmos during a period of 20 years. Ocular movements were limited in all directions. Upon exploration, a mass of inflammatory tissue was removed from the orbit which consisted essentially of dense cicatricial tissue. Orbital radiography showed erosion and diffuse osteoporosis of the superior external border of the left orbit that suggested a neighboring inflammatory process. This case conformed to Birch-Hirschfeld's class 2.

A 22-year-old woman had a slight ptosis, and a hard tumor that involved the upper external angle of the orbit. Otherwise both eyes were normal and had normal vision. A rounded mass was removed which included a part of the lacrimal gland. The pseudotumor was considered secondary to dental infection.

The third patient was a woman, 67 years of age, who had developed an almond-sized painless mass in the right orbit near the superior external angle during the previous year. Otherwise both eyes were normal except for a senile macular degeneration. Under the orbitotarsal fascia an extremely friable and unencapsulated tumor was removed. This consisted largely of lacrimal gland with chronic inflammatory changes. (17 references.)

Chas. A. Bahn.

Bey, Handousa. **Some observations on the symptomatology and diagnosis of cases of proptosis.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 155-160.

Bey reports his experience with proptoses. The largest number, 31, originated from intraorbital lesions such as inflammation, cysts, and neoplasms. A few were secondary to diseases of the paranasal sinuses, and a small group were caused by traumatic, inflammatory, and neoplastic changes in the bony wall of the orbital cavity.

Morris Kaplan.

Delsores, Jose. **Orbital phlegmon treated with sulfanilamide.** Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, July, pp. 673-675.

The patient was given five grams of Leuco-tiazol by mouth daily during the first four days (0.5 Gram every two hours) and four Grams daily the next three days. At the end of the eighth day the inflammation had subsided. The above dosage was sufficient to keep the blood concentration of the drug at the effective level.

J. Wesley McKinney.

Esente, Ivan. **Radiologic and histologic study of two eyeballs containing ossifications.** Riv. di Oftalm., 1946, v. 1, Sept.-Oct., pp. 604-616.

Comparison of radiograms and microscopic sections of two atrophic eyes proved the value of radiologic examination for diagnostic purposes. The bony tissue was derived directly from the connective tissue. (10 pictures, bibliography.)

K. W. Ascher.

Forbes, S. B. **Exophthalmos in relation to orbital tumors; report of eight cases.** South. Med. J., 1947, v. 40, March, pp. 206-213.

This is a report of eight cases of unilateral exophthalmos. In four the proptosis resulted from a primary orbital tumor, in three from a tumor outside the orbit, and in one from a primary pseudotumor. A lipoma was not changed by irradiation, and transconjunctival surgery was done. Now there is a slight enophthalmos. A squamous cell carcinoma occurred about the left orbit and sphenoidal ridge (presumably metastatic, though the primary focus was not found), and the patient died about nine months after the eye had begun to protrude. A third patient had a pyocele of the ethmoid which was treated surgically with success. A mucocele of the ethmoid was similarly treated with an excellent result. The fifth patient developed exophthalmos after a second thyroidectomy. A Krönlein operation was done. The lateral and inferior muscles were very large. A pseudo-tumor receded after irradiation in fractional doses. The other two cases resulted from benign cavernous hemangiomas; in both a Krönlein operation was done, with good results. (12 photographs.) Bennett W. Muir.

Kestenbaum, Alfred. **A new principle of relative exophthalmometry.** Confinia Neurologica, 1946, v. 7, no. 3-4, pp. 113-120.

While the patient is looking upward, a ruler is held horizontally in front of and parallel to the patient's face. The inferior edge of the ruler is on the same level as the lowest point of the limbus. The distance between the limbus and ruler is equal to the width of the ruler. The observer looks over the ruler's upper edge and brings his head to a level where he sees the left inferior edge of the patient's limbus with his right eye, aligned with the upper edge of the ruler. Then he looks at the other eye without changing position. If relative enophthalmus is present, a strip of sclera will be visible above the edge of the ruler. The measurable strip of visible sclera equals the degree of relative enophthalmus. (2 figures.)

Irwin E. Gaynon.

Moreira de Andrade, Luiz. **General considerations on a case of traumatic pulsating exophthalmos.** Rev. Brasileira de Oft., 1947, v. 5, March, pp. 171-178.

A youth aged 16 years received a violent blow on the head from the door of a bus in which he was riding, and was taken unconscious to the hospital. There was a fracture in the right temporo-parietal region, disclosed by X ray. Examination showed moderate exophthalmos on the right side, reduced movement of elevation of this eye, and homonymous diplopia. Both external rectus muscles were inactive, and there was a distinct Babinski reflex on the left side. Some weeks later the patient complained of intense headache and a buzzing. The conjunctival vessels were considerably disturbed, there was considerable chemosis in each eye, and exophthalmos in each eye but especially the right. Vision was right 2/3, left 1. Pulsation was noticeable on palpation on each side, and a bruit was audible through the stethoscope, especially on the right side. Improvement followed ligation of the right common carotid. (References.) W. H. Crisp.

Seidenari, Renato. **Two typical cases of Charlin's syndrome.** Riv. Oto-

Neuro-Oft., 1943, v. 3, May-June, pp. 177-183.

In 1930, Charlin described a syndrome that consists of alterations of the sensibility (pain in the nasal upper orbital angle, in the ala nasi, and in the eye), of the lacrimal secretion (rhinorrhea) and of the sudoriferous glands (hyperhydrosis), vasomotor changes (hyperemia) in the conjunctiva and the nasal mucous membranes, and trophic changes in the cornea (small ulcers) and in the iris (iritis). Nasal therapy with cocaine and adrenaline solution brought relief in two cases observed by the author. (Bibliography.)

K. W. Ascher.

Vances, P., Ianou, A., and Metianu, I. **Subacute staphylococcal septicemia with severe orbital maxillary symptoms cured by penicillin.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 511-523.

A five-weeks-old infant with facial pyoderma since birth developed severe palpebral and conjunctival edema with exophthalmos, a seropurulent nasal secretion, a slight deformation of the palate and severe febrile symptoms. During the following ten days the ethmoids were curetted and the lower temporal portion of the orbit was drained. Penicillin (50,000 units) was injected into the orbital tissues. The ocular symptoms greatly improved until the eighteenth day when a recurrence began. The orbital wound was drained, penicillin (10,000 units) was immediately injected into the orbital tissues, and one half of the quantity was injected every three hours. One week later the patient was practically well. The authors believe that the lesion was the result of a staphylococcic septicemia that resulted from the facial pyoderma. Staphylococci were identified by staining and culture in the affected tissues. A constitutional predisposition (lymphatic exudative diathesis) made possible the secondary staphylococcal infection that rapidly extended into the nose, paranasal sinuses, and orbit. (51 references.)

Chas. A. Bahn.

## 14

## EYELIDS AND LACRIMAL APPARATUS

D'Eramo, C. **Congenital fistula of the lacrimal canal.** Anales Argentinos de Oft., 1946, v. 7, July-Aug.-Sept., pp. 79-80.

A five-year-old child is presented who had tearing of the left eye since birth, and a small discharging orifice about five millimeters below and internal to the inner canthus. Exploration of the orifice by irrigation showed that fluid entered the sac and appeared at the inferior nasal meatus. The author felt the fistula was congenital and he contemplated surgical extirpation. (1 radiograph.)

Edward Saskin.

Kiskadden, W. S., and McGregor, M. W. **Coloboma of the eyelids.** Plastic and Reconstructive Surg., 1947, v. 2, Jan., pp. 60-65.

The authors present a case of congenital coloboma of the inner portion of each upper eyelid in an infant, one of unidentical twins, aged one week. Boric acid irrigations and ointment did not prevent some corneal ulcerations although thorough care was given by the infant's mother, a nurse. When the child was 2½ months of age, surgery was performed. The technique, as well as that of Falchi, Wicherkiewicz, Peer, and Hughes is described. The original corneal scarring has largely disappeared and it is believed that little permanent defect will result.

Francis M. Crage.

Landau, J. **A case of congenital vertical shortness of the lids combined with tetrastichiasis.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 219-222.

The author reviews the literature, and presents an unusual case of congenital vertical shortness of the lids. The patient also had tetrastichiasis, combined with a partial eversion of the cutaneous part of the upper lid margin. It appeared that the hair follicles of the supernumerary cilia had taken the place of the Meibomian glands, and occupied their ducts. No inflammation of the eyes had occurred. O. H. Ellis.

Harms, H. H., and Ryerson, F. L. **Coloboma of optic nerve.** J. Michigan M. Soc., 1947, v. 46, Feb., pp. 214-215.

The authors describe a coloboma of the left optic nerve in a 51-year-old Negro woman. The findings were negative except for a four-disc-diameter excavation that is 12 diopters deep. The deepest inferior portion is blue white, and the area above is bluish pink, and has a veil. The vessels bend sharply over the inferior margin of the disc. The superior portion of the optic disc is normal. Central field studies revealed an enlarged blindspot.

Irwin E. Gaynon.

Price, H. W. **Dacryostenosis.** J. Pediat., 1947, v. 30, March, pp. 302-305.

Of 203 infants with dacryostenosis 192 recovered with conservative therapy which consisted of irrigation of the eye with boric acid solution and pressure over the lacrimal sac. The latter is applied three times daily. With a rocking motion from above downwards at the inner canthus an attempt is made to expell the contents of the sac through the nasolacrimal duct into the nose. Irwin E. Gaynon.

Seidenari, Renato. **Study of the bony part of the nasolacrimal duct and of the nasal mucous membrane surrounding the orifice of the nasolacrimal duct.** Minerva med., 1947, v. 1, Feb. 10, pp. 176-181.

Investigations of the nasal mucous membranes and the bony ducts of four corpses showed that dacryocystitis need not be connected with inflammatory disease of the nasal mucosa surrounding the orfice of the nasolacrimal duct. There is, however, a narrowing of the bony ducts and a more winding course than in individuals not affected by dacryocystitis. The veins of the mucous membrane of the duct form a dense network, almost an erectile tissue according to Magitot; slight nasal congestion may suffice to bring the mucous membranes of the nasolacrimal duct into apposition, which may be followed by permanent adhesions. Narrowing of the duct, as found in the specimens described, is a contributory factor. If the nasal disease recurs, another adhesion may form above and below the first one. The nasolacrimal ducts of persons without dacryocystitis are wider and less winding. (9 figures.)

K. W. Ascher.

Seidenari, Renato. **Histopathology of the nasal mucous membrane adjacent to the os unguis in dacryocystitis.** Minerva med., 1947, v. 1, Feb. 10, pp. 181-186.

Ten cases of dacryocystitis were used for a study of the mucous membranes obtained during dacryocystotomy. Special attention was devoted to the epithelial cells, the cellular infiltration, and to the vessel walls of the region possibly responsible for the development of the dacryocystitis such as the ethmoidal anterior sinus. In eight patients the findings were completely normal only two specimens were characterized by

definite inflammatory changes. (6 figures.) K. W. Ascher.

Spaeth, E. B. **Correction of some forms of acquired ptosis.** Plastic and Reconstructive Surg., 1947, v. 2, Jan., pp. 37-43.

The greater number of cases of acquired ptosis fall into three surgical subdivisions. In the Hess technique the resultant cicatricial bands bring the desired result; in the Reese technique the orbicularis is utilized; and in the third a classical advancement of the levator is combined with the resection and tarsectomy to increase the effectiveness of the levator.

The Hess procedure is indicated in the correction of ptosis associated with any type of lid reconstruction. Acquired ptosis where trauma has produced thick, ptotic lids and cicatrices, and where little orbicularis action remains, calls for the Hess operation. Where trauma has severed the levator, the orbicularis should be transplanted into the occipitofrontalis muscle. If the orbicularis is destroyed a transplant of fascia lata may be made. When the levator is only partially severed, reattachment is not difficult.

Surgical suggestions are made for the treatment of other anatomic defects associated with acquired ptosis. Five cases are presented.

Francis M. Crage.

## 15

### TUMORS

Babel, J. **Orbital chronic inflammation and pseudo-tumors.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 540-550. (See Section 13, Eyeball and orbit.)

Laval, Joseph. **Hemorrhage in sarcoma of the choroid.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 607-609. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Reese, A. B. **Pigmented tumors.** (The de Schweinitz lecture.) Amer. Jour. Ophth., 1947, v. 30, May, pp. 537-565. (16 figures, 1 table, 56 references.)

## 16

### INJURIES

Arentsen, Juan. **A case of sympathetic ophthalmia cured with penicillin.** Arch. Chilenos de Oft., 1946, v. 2, March-April, pp. 118-123.

The patient was a boy of 12 years, injured in the right eye with a dynamite cap. The penetrating corneal wound was badly infected, and the condition improved rapidly under penicillin given locally and generally. It is difficult to understand why the author speaks of a case of sympathetic ophthalmia, since the injury had occurred only five days earlier, and the left eye remained completely healthy.

W. H. Crisp.

Vail, Derrick. **Early treatment of ocular injuries.** Industrial Med., 1947, v. 16, April, pp. 173-174.

The author appeals to the industrial surgeon for early treatment of ocular injuries which rank second to none in importance. He clearly outlines the proper procedures to be used.

O. H. Ellis.

Van Arsdell, P. M. **First aid for chemical eye injuries.** Industrial Med., 1947, v. 16, April, pp. 188-196.

The ocular reactions to acids, alkalies and salts are extensively tabulated, and our knowledge of these effects widened. The fact is stressed repeatedly that no treatment of chemical eye injury compares with immediate copious irrigation with water. This is the most effective first-aid measure. O. H. Ellis.

# NEWS ITEMS

Edited by Donald J. Lyle, M.D.
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News items should reach the editor by the 12th of the month

## Deaths

Dr. Edgar Leonard Goodman, Washington, D.C., died February 28, 1947, aged 44 years.

Dr. John Greenwood Jennings, Boston, Massachusetts, died February 17, 1947, aged 58 years.

Dr. Frederick Manwaring Law, New York, New York, died February 12, 1947, aged 71 years.

Dr. Walter Ivan Lillie, Philadelphia, Pennsylvania, died February 21, 1947, aged 55 years.

## Miscellaneous

### Eye-Bank for Boston

An affiliated Eye-Bank has been organized in Boston and is ready to serve the needs of New England. It is located in the Massachusetts Eye and Ear Infirmary building at 243 Charles Street. Seven hospitals in the Boston area and one in Maine have already become affiliated with it. The general public in New England is being urged to sign forms, available from the Boston Eye-Bank, indicating their willingness to donate their eyes for use after death.

Henry Hixon Meyer, William S. Ballard, and Dr. Edwin B. Dunphy constitute the executive committee of the Boston Eye-Bank's Board of Sponsors. The board includes leading ophthalmologists throughout New England; business, industrial, and religious leaders; and representatives of the eye departments of various hospitals in the area.

### Study Council Course

On June 20th the summer course in ophthalmology given under the auspices of the Ophthalmological Study Council opened at Westbrook Junior College, Portland, Maine. The course, which will run until September 13, covers such subjects as anatomy, pathology, bacteriology, physiologic optics, neuro-ophthalmology, surgical principles, glaucoma and general diseases, and ophthalmoscopy. There is laboratory work in pathology and optics and practical work in slitlamp, perimetry, and refraction.

### Train mothers of blind children

The Iowa State Commission for the Blind is planning to offer a week of training for mothers with visually handicapped children under the age of five years. It will be held at the Iowa School for the Blind at Vinton. Designed to acquaint mothers with the type of training which will be beneficial to their children, the course consists of a preschool training program. There is to be no registration fee, and board and room will be provided for both mothers and children. Matrons will look after the children while the mothers attend the meetings. Further information may be obtained from Mr. Leslie M. Hays, Superintendent, Iowa School for the Blind, Vinton.

### Eye-bank fellowships

Seven fellowships for research and 16 scholarships for its training course have been granted during the past year by The Eye-Bank for Sight Restoration, Inc. Physicians from other countries who have received awards include: Dr. John P. Blum, Geneva, Switzerland; Dr. Walter Kornbleuth, Jerusalem; Dr. Geminiano de Ocampo, Manila; Dr. M. K. Yuo, Fukien, China; Dr. P. K. Kuo, Shanghai; and Major M. M. A. Dubash, Bombay, India.

## Societies

### Antibiotic therapy discussed

The Reading Eye, Ear, Nose and Throat Society and the Reading Dental Society met jointly on May 21st. The speaker was Dr. John A. Kolmer of Philadelphia. His topic was "Antibiotic Therapy in Relation to Dentistry and Ophthalmology."

### New officers elected

At the May 5th meeting of the Louisiana-Mississippi Ophthalmological and Otolaryngological Society at Biloxi, Mississippi, Dr. Noel Simmonds of Alexandria, Louisiana, was elected president and Dr. Edley H. Jones of Vicksburg, Mississippi, was reëlected secretary. The 1948 convention will be held in New Orleans, Louisiana.

### Carolinas to have joint meeting

The second annual meeting of the North Carolina Eye, Ear, Nose, and Throat Society and the South Carolina Society of Ophthalmology and Otolaryngology will be held at the Hotel Skyland, Hendersonville, North Carolina, on September 15th to 18th. The first two days of the program will be devoted to ophthalmology, and the speakers will be Dr. Harold Brown, Dr. John H. Dunnington, and Dr. Brit-

tain F. Payne of New York, and Dr. Jack S. Guyton of Baltimore.

Information about this meeting may be obtained from the officers of either Society. Those representing North Carolina are: Dr. V. K. Hart, president, Charlotte; Dr. W. E. Brackett, vice-president, Hendersonville; and Dr. J. A. Harrill, secretary-treasurer, Winston-Salem. The South Carolina officers are: Dr. Ruskin G. Anderson, president, Spartanburg; Dr. S. Harry Ross, vice-president, Anderson; and Dr. Roderick Macdonald, secretary-treasurer, Rock Hill.

### New York Society officers

The newly elected officers of the New York Society for Clinical Ophthalmology are: Dr. Daniel Kravitz, president, and Dr. Leon Ehrlich, 211 Central Park West, New York City, corresponding secretary.

### Milwaukee holds annual meeting

The annual meeting of the Milwaukee Oto-Ophthalmic Society was held on May 27th. The following members were nominated as officers for the coming year: Dr. Frank Treskow, president; Dr. S. S. Blankenstein, vice-president; and Dr. George Dunker, secretary-treasurer. Dr. Mark Bach, Dr. J. P. Wild, and Dr. Meyer Fox were nominated as directors. Motion pictures of fishing in Canada were shown by Dr. Herbert Schmidt, and various members of the Society showed travel slides.

### Chinese society speaker

When Sir Clutha Mackenzie of New Zealand studied the problems of the blinded soldiers in China at the invitation of the Chinese government, he stopped at West China Union University and addressed a combined session of the Chengtu Ophthalmological Society and the Chengtu Eye, Ear, Nose, and Throat Society.

## Personals

### Awarded silver medal

The Illinois State Medical Society has awarded a silver medal to Dr. Bertha A. Klien, associate professor of Ophthalmology, Northwestern University School of Medicine, for the exceptional educational value of her exhibit, "Diseases of the Fundus Oculi," shown at the 1947 meeting of the Society at the Palmer House, Chicago, in May.

### Dr. Barkan speaks in Holland

Dr. Otto Barkan of San Francisco was the guest speaker at the annual meeting of the Netherlands Ophthalmological Society and the Society for the Prevention of Blindness in Amsterdam, Holland, on June 7th and 8th. The subject of his paper was "Glaucoma Operations."

### N.S.P.B. Vice-President

Dr. Conrad Berens of New York City was elected vice-president of the National Society for the Prevention of Blindness at the semi-annual meeting of the board of directors.

### Professor Fuchs to lecture

During June and July, Prof. Adalbert Fuchs of Vienna, who is visiting China under the auspices of the UNRRA, will deliver a series of lectures and conduct clinical demonstrations at the Department of Ophthalmology, West China Medical College, Chengtu, Szechwan, China.

### To give de Schweinitz lecture

On November 20, 1947, Dr. Bernard Samuels of New York will give the 10th annual de Schweinitz Lecture before the Section on Ophthalmology of the College of Physicians of Philadelphia. Dr. Samuels' subject will be: "Necrosis of Intraocular Tissues."

### Mexican Society speaker

Dr. Joseph I. Pascal will read a paper on "Spherical Equivalent of Cross-Cylinder Tests," at the meeting of the Mexican National Society for the Prevention of Blindness to be held in Mexico City, August 11th to 15th.